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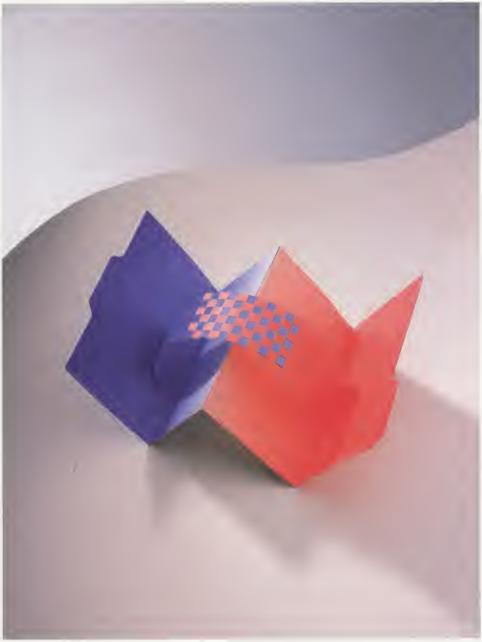

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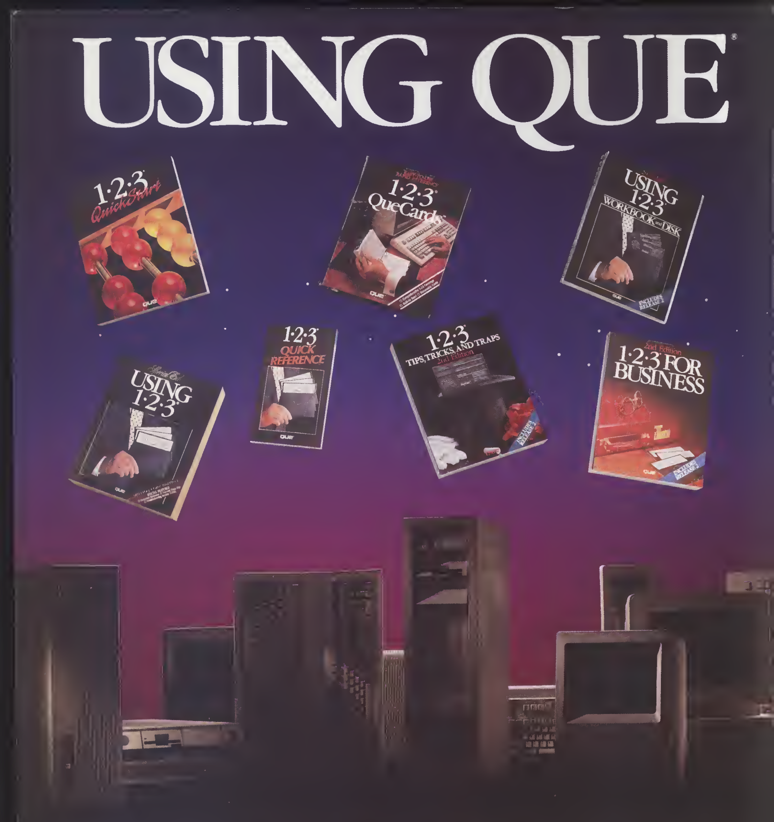

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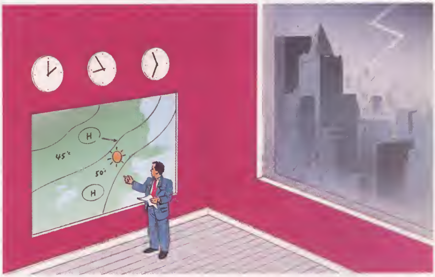

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STAFF LETTER

HOW WE TRY TO BE ALL YOU NEED

Every now and then, a reader takes the trouble to say something like, "You're the only computer magazine I read." That produces a warm glow here—but, I assure you, no illusions.

We know that those of you who are "power users" or who are charged with major PC responsibilities in your company need more than we can stuff into our pages each month. That means turning to one or more of our excellent competitors as well.

Still, we know that most of you mainly want to solve business problems. And a large number of you depend on *us* for what you need to know about computer software and hardware.

We try to respond. For proof, let me point to a number of items in this issue.

There is, for example, the detailed comparison of *dBase IV* with its predecessor, on page 82. We can't write about every database program that comes along, but for those of you who use a database program, *dBase* is by far the leader. We believe our review gives you what you need to make an informed upgrade decision.

Similarly, we can't write about every disk utility that comes along. But we try to write about the best ones, and there's a lot on disk utilities in this issue, both in Reviews and in New Products.

One review compares the abilities of a specialized package called *Rescue Plus* and the venerable *Norton Utilities*. The question is whether the newcomer does a better job of recovering worksheets, specifically, than the *Norton* package, which many of you have.

Close by, we have new-product stories on *Lotus Magellan* and Traveling Software's *ViewLink*. Each, in a different way, helps you find the files you've stored on a hard disk. Each has capabilities that go beyond what's been available previously.

There is another way in which we try to be the only computer magazine you need, and that is in our Ideas & Trends section. From the very beginning, that's where we've tried to keep you abreast of the major trends in PCs that may affect you, now or later.

In this issue, we are expanding that service a bit. We want to treat some issues at greater length than our I&T format allows. So you will find in our feature section a three-page article about executive information systems. It's a broad, easy-to-read piece that, unless you're actually designing an EIS, tells you most of what you need to know about the subject.

For those of you who just want the goods on *1-2-3*, be reassured. That's here in abundance. If you resolutely avoid *dBase* and try to make the most of *1-2-3*'s database capabilities, for example, you will want to turn to the macros article on page 27. There, Nick Delonas tells how you can break through DOS's memory constraints by designing a *1-2-3* database that lives mostly on disk, not in memory, even while you're working with it.

Whether or not that grabs you, our @LOTUS department certainly will. Turn to page 6 to find out, finally, about the upgrade to *1-2-3* Release 3—and about an alternative you may prefer: a lesser upgrade to the long-rumored Release 2.X, now officially 2.2.

John B. Campbell
Editorial Director

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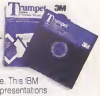

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LETTERS

ALLWAYS AVAILABILITY

I am writing in protest about your New Products article on *Allways* [December]. The article leads readers to believe that by purchasing *1-2-3* they are entitled to a copy of *Allways.*

Raymond M. Falcon Jr.
Bellaire, Tex.

Editor's note: *Our information was inaccurate. We should have said, "For a limited time,* Allways *is free with the purchase of* 1-2-3 *Release 2.01 at participating Lotus dealers. Contact your dealer for the specific terms of its participation."*

MORE ON LOAN PAYMENTS

In "Track the Payments on Your Loan" [September], the interest incurred on the loan was calculated on a monthly basis from a known annual percentage.

Can the interest be calculated in the same manner if only the total interest on the debt is known? The total interest can easily be calculated by multiplying the number of payments to be made by the monthly repayments, then deducting the amount of the original loan.

John Roberts
Adelaide, South Australia

Editor's note: *Your question implies that you don't know the interest rate on which the loan is based; that is, you ask a bank for a loan of $15,200 and the bank says, "Certainly. Pay $496.91 every month for the next three years." From this information, you can determine the interest rate with the @IRR function.*

*Let's assume first that payments are due at the ends of periods. Retrieve the amortization worksheet shown in figure 1 in Nelson's article. Make sure that cell B4 contains 0. Set the width of column F to 12. Enter the amount of the principal as a negative number, in this case −15200, in cell F1. Enter the payment amount as a positive number, in this case 496.91, in cell F2 and copy cell F2 to range F3..F37. In other words, you must have the payment amount in 36 contiguous cells because there are 36 monthly payments in a three-year loan. Then in cell G1 enter the formula @IRR(0.1,F1..F37)*D9 and format cell G1 for percent with one decimal place. This tells you the interest rate the bank is using, 10.9%. Enter the formula +G1 in cell D10, and press the CALC key.*

*If payments are due at the beginnings of periods (the loan is on an annuity-due basis), the amount you enter in cell F1 is the negative of the principal plus one payment, and the number of cells containing the payment amount should be one fewer than the stated number of payments. The first payment is made before the loan has time to accrue any interest, so the first payment is, in effect, deducted from the principal. Follow the instructions above, with these exceptions: In cell B4 enter 1. In cell F1 enter −15200+496.91. Then erase cell F37, and edit the formula in cell G1 to read @IRR(0.1,F1..F36)*D9. Then press the CALC key.*

THE WIDER THE ANGLE

I don't usually worry about computerized trig programs because I have little need for them. However, your response to Jerzy Czarnik's letter [January] on "Sine Here, Please" [June] raised warning hackles. To say that the order of entry makes a difference suggests that there is something wrong with a program that purports to be a "general-purpose triangle solver."

I suspect that the program will work nicely as long as none of the interior angles exceeds 90 degrees. Czarnik has thrown it a tough proposition by suggesting a triangle in which one of the angles is around 104 degrees. What has happened is that the program is incapable of differentiating between an angle whose cosine is −0.2381 (103.8 degrees) and an angle whose cosine is +0.2381 (76.2 degrees).

There is nothing intrinsically wrong with order-sensitive programs, but both purveyor and user should be aware of the pitfalls that lurk therein.

Dr. Charles B. Hoelzel
Wilmington, N.C.

Editor's note: *We took a closer look at Ken Saul's worksheet and at Jerzy Czarnik's letter. Trying different combinations of side lengths, we discovered that the problems arise when the value entered for side 2 is big enough to make angle 3 greater than 90 degrees. Specifically, as the length of side 2 increases in relation to sides 1 and 3, the result of the formula in cell E24 increases until it reaches 90 degrees and then starts to decrease.*

Ken Saul has provided us with an alternate formula for cell E24 of the triangle worksheet:

2*@ACOS(@SQRT((C22+C23+C24)/2*((C22+C23+C24)/2−C23)/(C22*C24)))/convert

TO GO GRAPHICAL OR NOT

"Pictures Are Better Than Words" [September] was most informative. As a mere PC user, however, I beg to differ with the author, Bill Gates.

There are users out here in the real world who do not spend all their waking hours staring at TV screens. Some of us can actually understand words and even prefer text to fancy pictures.

What is needed is not a graphical user interface, profitable though that may be for Mr. Gates, but decent software. With fully integrated software that combines data management, spreadsheet, graphics, text, and communications in one package, the need for data interchange between applications disappears. Combine this with a natural-language interface and an expert system and you have the tools with which to develop very high quality, user-friendly applications.

P. M. Burtenshaw
New Zealand Forestry Corp.
Wellington, New Zealand

IMPROVEMENTS ON BREAK-EVEN

While "Know Your Break-Even Point" [December] is clearly written and the explanations are good, Ken Saul's analysis is inappropriate to the task at hand. His method works only if you know exactly where you are going in the first place. It offers no help if you want to find your own break-even point.

Saul's way of sorting the collected data is fine if you are positive that there is no information, such as a trend with time, in the prior order of the series. Saul knew there was no time dependency in his data, but will you know that about your data? If there is a trend, the remainder of your analysis will be faulty, and you won't know why unless you examine the data in its collected order before sorting it.

Saul arbitrarily chooses a second-degree polynomial as a best fit for the data. In fact, his discussion labeling the polynomial fit (and there are an infinite number of fits) as curvilinear regression suggests that a second-degree polynomial is the only model to use in fitting curved data.

Saul makes no attempt to verify that the model fits his data. Once the data is fitted, it is never examined again. He so abandons the data that the rest of the analysis is done on a brand-new worksheet.

I would build the data to be plotted on the same sheet as the initial analysis. I'd also pick up the coefficients of the model equations directly from the regression output as an absolute reference. Likewise, the fixed-cost values should be placed in cells of their own and picked up by the formulas. That way, no formula needs adjustment as the data changes with time.

It is also advisable to plot the original data on the output chart. With real-world data, you might find it a long way from the pretty curves the model draws. It is a grim fact of regression analysis that even very high correlation coefficients (=> 0.8) can allow individual data points to deviate strongly from the remainder of the data. These outliers could bear further examination.

Raymond J. Clare
Bryan, Ohio

Author's note: *Your concerns about examining the data for other dependencies is well taken. Business data will often have seasonal trends or depend heavily on such outside factors as the big sale next door or the weather. The data presented was hypothetical and assumed no significant dependencies on anything but the number of loaves baked.*

As for the correctness of using a second-order equation, I refer you again to the article "Curvilinear Regression in Release 2" (May 1987), in which the authors present sufficient statistical tests to ensure that the order is optimized.

The regression analysis and the break-even analysis can easily be combined into a single worksheet if desired. For example, retrieve the worksheet shown in figure 3, move the cell pointer to cell I1, and use the File Combine command to combine the worksheet shown in figure 4. You can edit the formula that's now in cell J2 to include absolute references to the regression output. You can also enter the assumptions for the cost formula—the fixed cost of $200 and the variable cost of 50 cents per loaf—into cells N1 and O1, respectively. The profit formula in cell J2 would then be `($F$9*K1+$G$9*K1^2+$G$3)-($N$1+$O$1*K1)`.

PARADOX OR NOT

Daniel Seligman made a mistake in his essay "But What Was I To Do?" [September]. What he referred to as Bertrand Russell's paradox was no paradox at all. If both sides of the paper read "The statement on the other side of this paper is false," then if side 1 is true, it implies that side 2 is false. If side 2 is false, it implies that side 1 is true.

The real paradox is when side 1 says "The statement on the other side of this paper is false" and side 2 says "The statement on the other side of this paper is true." Which side is true? If side 1 is true, then side 2 is false. But if side 2 is false, then side 1 is false. In that case, side 2 is true, and so on.

William Meacham, Systems Analyst
Sheshunoff Information Services
Austin, Tex.

Author's note: *Yes, Mr. Meacham, what you call a paradox is indeed a paradox. In his autobiography (Little, Brown and Company, 1967), Russell calls the example I cited a contradiction. To prove that his statement is not contradictory, you posited that the statement on side 1 is true, even though it was labeled false on side 2. Russell, however, wants you to take the two statements together, in which case the truth of either statement requires it to be untrue.* ■

@ERR

"A Guide to Public Domain Software" (January): The World of Lotus file called DLSUM.ARC, mentioned on page 51, is now called LIBSUM.ARC.

"Time Line" (January): The correct address and phone number of Symantec Corp. for the "In Brief" box on page 93 is 10201 Torre Ave., Cupertino, CA 95014; 408-253-9600.

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LOTUS INTRODUCES A FAMILY OF SPREADSHEETS

1-2-3 Releases 3 and 2.2 dramatically increase power, ease of use

It's taken more than two years, but Lotus Development Corp. thinks it is nearing its goal of providing a spreadsheet to fit the needs of almost everyone. *1-2-3* Release 3 brings advanced technology to the worksheet, while *1-2-3* Release 2.2 adds features and greater ease of use to Release 2.01.

1-2-3 Release 3 is a major upgrade of *1-2-3* Release 2.01. It will run under DOS and OS/2, but only on 80286 or 80386 PCs. It has a built-in DOS extender that lets you access expanded memory beyond DOS's 640K limit. Also built into Release 3 are several new spreadsheet technologies, including three-dimensionality, access to external databases, and advanced networking capabilities.

Release 2.2 will have a suggested retail price of $495. Release 3 will cost $495 through the end of 1989, $595 thereafter.

Those who bought *1-2-3* Release 2.01 after September 6, 1988, are eligible for a free upgrade to either Release 2.2 or Release 3 for a limited time after the product ships. The upgrade price for versions of *1-2-3* purchased prior to September 6, 1988, is $150 for Releases 2.2 and 3.

Lotus has promised shipment of Release 3 by the end of June. At press time, no ship date had been announced for Release 2.2.

Here's a rundown on the main new features of each spreadsheet product.

1-2-3 RELEASE 3

Three-dimensional worksheets This new feature can help you organize your applications. Although a worksheet cannot be larger than 256 columns wide by 8,192 rows long, a single file can now contain as many as 256 active worksheets. In a single file, for example, you can have a database on one worksheet, a report on another, and macros on a third. Each worksheet can be protected from insert and delete operations on other worksheets in the file.

The worksheets appear "stacked" on your screen, and you can perform worksheet operations on three-dimensional ranges.

File linking Release 3's new file-linking feature lets you link individual cells in a worksheet to individual cells in other worksheets. Formulas, for example, can reference not only cells in the active worksheet but also cells in worksheets in other files. You can update links manually by using the Link Refresh command; otherwise, links will be updated when you retrieve a file or create, change, or move a link.

Multiple files in memory A new command, File Open, lets you load an additional file without overwriting the current file. This is particularly useful for comparing files and creating links among files.

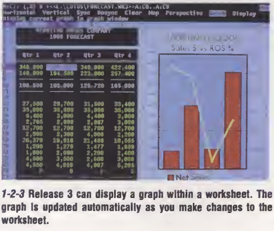
Improved recalculation You can reduce recalculation time by using minimal, background, and restartable recalculation. With miminal recalculation, only those formulas or cells that are affected by a change are recalculated. Background recalculation lets you continue working while *1-2-3* recalculates a worksheet, and you can interrupt the recalculation, make a change to the worksheet, and restart recalculation.

Other changes to the worksheet An Undo command reverses the last action you took, making it easier to recover from errors.

An auditing feature shrinks all worksheet columns to a width of two characters and displays symbols that indicate whether cells contain labels, numbers, or formulas. This bird's-eye view helps you locate errors in worksheet structure or logic.

The new release includes Search and Replace commands that can find and replace text in labels and formulas. You can also annotate formulas and range names. A cell can now hold up to 512 characters, more than twice as many as in previous *1-2-3* releases. In addition, the Release 3 control panel will display the entire contents of a cell, making it easier to edit long formulas and labels.

Changes to graphics The PrintGraph program has been eliminated. You can now print graphs right from *1-2-3*. A new feature lets you view a graph alongside the current worksheet. A "hot link" updates the graph automatically as values change in the worksheet.



***1-2-3* Release 3 can display a graph within a worksheet. The graph is updated automatically as you make changes to the worksheet.**

New graph types include high-low-close-open, for plotting stock prices, and a mixed bar-and-line graph. Release 3 also lets you specify two Y axes on the same graph. A Graph Group command lets you define all data ranges at once rather than specify each range in a separate step. And a new Quick Graph feature creates and displays a graph with just a few keystrokes.

Printing enhancements New print features include support for PostScript printers and proportionally spaced text. You can select condensed print from the Print menu, as well as fonts and landscape mode or portrait mode for laser printers. And you can continue to work in *1-2-3* while the program prints your document.

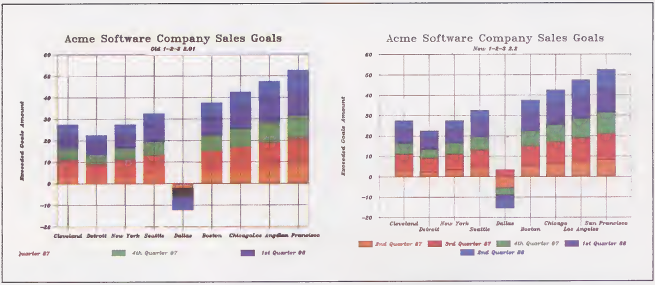
Database changes These include more sort keys and better database-report features. Release 3's database capacity has been extended to 256 fields. The number of sort keys has also increased to 256. The biggest improvement, however, is that you can access external databases from your worksheet, whether they are on mainframes, network servers, or CD-ROMs.

Once you establish a connection between Release 3 and an external database, you can use the Data Query commands to find and manipulate records in the external database. A special driver for *dBase III* is included with Release 3.

New macro features A Macro Library Manager lets you store a collection of macros in a separate worksheet and retrieve any macro in the collection into almost any worksheet. When you load a library, it remains in memory throughout a work session, even when you erase the current worksheet or retrieve another. Release 3 also provides new macro keywords for moving among worksheets and accessing external databases. Some keywords allow you to run DOS or OS/2 programs from *1-2-3*. Many, though not all, Release 2.01 macros will work in Release 3 without modification.

In addition, a Learn mode makes it easy to write simple macros by recording your last 512 keystrokes. You can then play back all or part of this script or copy it to a worksheet.

Release 3 also supports the new Lotus Extended Application Facility (LEAF), Lotus's new programming lan-



A stacked-bar graph created in *1-2-3* Release 2.2 (right) looks sharper than its Release 2.01 counterpart (left). Bars don't touch the graph frame, grid lines don't break through bars, and X-axis labels and graph legends appear on two lines.

guage. LEAF is a compiled, high-level language that offers new capabilities for customizing Lotus spreadsheet and future database products.

Compatibility Release 3 reads files created in all versions of *1-2-3* (WKS and WK1 formats) and *Symphony* (WRK and WR1 formats). However, it saves files in a new format: WK3. Releases 2.01 and 2.2 cannot read WK3 files, but you can save Release 3 files in WK1 format. This lets you use Release 3 files in previous versions of *1-2-3* as long as these files contain no functions unique to Release 3.

Network support You can share *1-2-3* Release 3 data and program files on 3Com 3+, Novell Netware, Banyan Vines, and IBM Token-Ring and PC networks. A file-locking method is built into Release 3. This means that if a file is in use, it is unavailable to others on the network except as a read-only file. Release 3 also respects network file-access and file-protection levels.

1-2-3 RELEASE 2.2

File linking In Release 2.2 you can link individual cells in one worksheet to individual cells in other worksheets. In this way, you can build large applications without using *1-2-3*'s File Combine commands. You can update links manually; otherwise, links will be updated when you retrieve a file or create, change, or move a link.

Minimal recalculation This feature, previously available in the *Lotus Speedup* add-in, improves a worksheet's performance and speed by recalculating only those cells that are affected by a change to the worksheet.

Other changes to the worksheet An Undo command lets you recover from your last command or operation. Release 2.2 stores in memory a complete copy of the previous state of the worksheet. However, with very large worksheets, you may not have enough memory for both the worksheet and the copy. In this case, you can turn off the Undo feature manually.

Search and Replace functions now let you search formula and label cells for text and perform individual or global replace operations.

Settings sheets are available for eight menu selections: Graph, Global, Default, Sort, Query, Regression, Parse, and Print. A settings sheet lets you see at a glance all the options for a selection and allows you to set them more conveniently.

New macro features A Macro Library Manager lets you store a collection of macros in a separate worksheet and retrieve any macro in the collection into almost any worksheet. When you load a library, it remains in memory throughout a work session, even when you erase the current worksheet or retrieve another. The Macro Library Manager is especially useful for those who use utility macros to help build worksheets and for developers who want to protect macros and data in their macro-driven templates.

An enhanced Step mode makes macro debugging easier. As you debug a macro, the current cell address and the contents of that cell appear at the bottom of the screen, and a cursor highlights the character or keyword being processed.

A Learn mode, previously available in the *Lotus Learn* add-in, has been incorporated into Release 2.2. The Learn feature provides a keystroke recorder that makes it easy to write simple macros.

Changes to graphics Release 2.2 provides no new graph types. However, a Graph Group command lets you assign all data ranges at once rather than specify each range in a separate step. In addition, if a graph's X-axis labels are too long to fit on one line, they will appear staggered on two lines. Likewise, graph legends will appear on two lines if they won't fit on one.

Several changes make for sharper-looking graphs. In bar and stacked-bar charts, for example, grid lines now appear behind the bars. Black lines outline the bars themselves and divide stacked bars. Release 2.2 also calculates left, right, top, and bottom borders so that bars don't touch the graph frame. The PIC file format remains the same, so existing *Freelance, Graphwriter*, and *Manuscript* files are fully compatible.

Add-ins The Add-In Manager has been incorporated into Release 2.2. From the main menu, the Add-In Manager lets you attach, detach, and invoke any add-in application or utility that currently works with Release 2.01. In addition, you can instruct Release 2.2 to attach as many as eight add-ins automatically when you load the program.

Compatibility Release 2.2 retains the WK1 file format.

Networking In a networking environment, Release 2.2 supports file locking. It runs under 3Com 3+, Novell Netware, Banyan Vines, and IBM Token-Ring and PC networks and respects the file-access and file-protection levels of their network operating systems.

System requirements Release 2.2 will probably be about 30K larger than Release 2.01. However, if you currently use add-ins in Release 2.01, you may actually end up with more memory in Release 2.2. Depending on which DOS version you have and the driver set you use, you'll probably have about 380K to 390K of available memory of DOS's 640K maximum left after loading Release 2.2. ■

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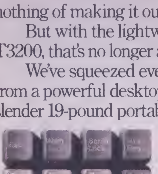

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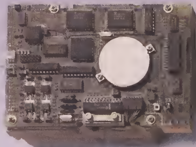

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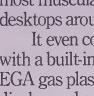

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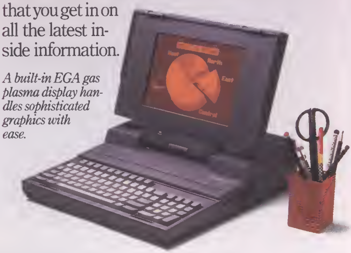

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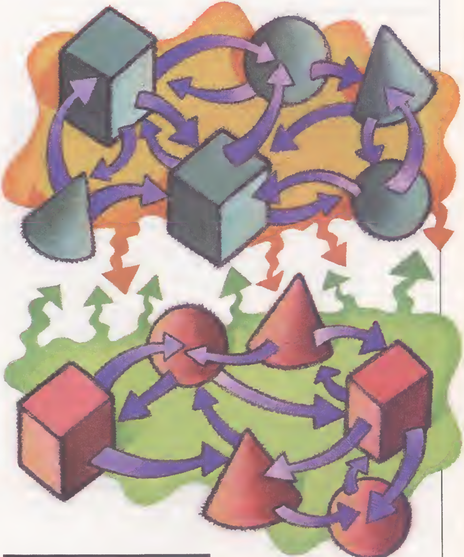

WHO MAKES THE BEST NETWORK SOFTWARE?

Novell and 3Com want to control your network.

A major fight is shaping up between two titans in the computer networking business, one of the computer industry's hottest segments. The battleground is the operating systems that manage the flow of information among desktop computers configured on local area networks (LANs). The contestants are two independent companies, Novell, of Provo, Utah, and 3Com Corp., of Santa Clara, Calif.

Novell's NetWare operating system is widely considered the de facto standard for connecting PCs to PCs. According to Rick Kimball, a communications industry analyst at Montgomery Securities in San Francisco, Novell holds more than 50% of the DOS LAN operating-system market. 3Com is a distant second. Since NetWare was first introduced in 1983, Novell has sold more than 300,000 copies worldwide. The company says its product now connects more than 3 million PCs.

3Com is the leading LAN hardware vendor. It specializes in complete network systems, including powerful PCs, called servers, special network workstations, interface adapters, and bridges that join local and remote networks. 3Com also expanded into network-to-network connectivity in 1987, when it merged with Bridge Communications (Mountain View, Calif.), a leader in the minicomputer network field.

3Com wants a bigger share

But 3Com is not content with selling just LAN hardware. While sales in its last fiscal year totaled $252 million, 3Com aims to be a billion-dollar company. It sees the burgeoning LAN software field as the way to achieve that goal.

3Com recently teamed up with Micro-

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soft Corp. (Redmond, Wash.), the leading PC software company. The result of the collaboration is 3+Open LANManager, a network operating system based on OS/2, IBM's and Microsoft's new PC operating system. 3Com is betting that as companies switch from DOS to OS/2, they will replace their network operating systems as well, moving from Novell's NetWare to 3+Open LANManager.

BY 1992, 65% OF ALL PERSONAL COMPUTERS WILL BE LINKED INTO NETWORKS. FEWER THAN 19% ARE LINKED TODAY.

Analysts expect a fierce struggle between the two companies. They also predict that, in the end, the real winner will be the user, who will see improved solutions to networking problems, along with better software for LAN applications.

The competition over network operating systems is being waged at a time when thousands of companies, from huge corporations to small storefront operations, are connecting PCs into networks. "You can compare it with the wiring of the world for telephone service that took place after World War II," says Alice Bradie, a senior technology analyst at Hambrecht & Quist, a venture-capital firm in New York. "The market is growing very, very rapidly."

According to Dataquest, a San Jose, Calif., market research firm, worldwide LAN revenues—for software and hardware—will jump from an estimated $4.2 billion last year to more than $10 billion by 1992. By then, networks will link more than 65% of all personal computers. They link fewer than 19% today, the firm says.

The advantages of linking computers are abundantly clear to corporate America. A pool of employees can share one laser printer. Desktop computer users can access the company's mainframe. Different departments or distant offices can send electronic messages back and forth. People working at a hodgepodge of different computers, such as Apples and IBMs or powerful workstations and dumb, diskless terminals, can exchange files.

Bypassing the minicomputer

As a result, some companies use PC-based LANs to handle all their computing needs, forgoing the purchase of mainframes and minicomputers altogether. "It's just more economical," says Montgomery Securities' Kimball. "PC LANS are cheaper than minicomputers."

That's certainly what the law firm of Dughi and Hewit in Cranford, N.J., found when it was hunting for a computer system to handle complex word-processing chores. Officers bypassed an expensive minicomputer system and instead purchased a 3Com LAN. According to Clark Landale, the network's administrator, the firm saved at least $30,000 in hardware and maintenance costs.

Experts say that a network of powerful personal computers can offer the same benefits as a minicomputer at about half the cost. Moreover, groups of employees can access information immediately rather than have to wait in line to use the minicomputer. "It makes life a lot easier, a lot more efficient," says Seymour Merrin, a PC consultant at Merrin Resources in Southport, Conn.

Lyle Sigmon, a computer-network consultant with LPS Consulting Co. in Fanwood, N.J., agrees. He says the cost of maintaining a minicomputer can equal the cost of installing an entire local area network, because a minicomputer usually requires the services of a full-time technician, while a PC LAN needs little upkeep.

In late February Hewlett-Packard Co. and 3Com finalized an agreement that calls for the two companies to jointly develop large-system network software. The 3Com-HP partnership paves the way for future versions of 3+ Open LANManager that support connections to minicomputer and mainframe servers, such as 3Com's 3S/400, HP's 3000 and 9000, and possibly the DEC VAX and IBM MVS.

One week after 3Com's announcement, Novell introduced Portable Netware, a version of Netware that supports a wide range of minicomputers. Portable Netware is designed to work with other operating systems, including OS/2 and Unix. Novell plans to license the source code to other companies. Twenty-three computer vendors, including Hewlett-Packard, say that they are interested in Novell's Portable Netware.

Besides 3Com and Novell, at least 30 other companies, including IBM, offer LAN products, such as network interface cards and specialized LAN software. According to Dataquest, the biggest player of all is Digital Equipment Corp., the Maynard, Mass., hardware giant, which had a 28% market share in 1987. But Digital has never been successful at selling personal computers, and most of its networking products are designed to connect its own VAX minicomputers to other computers. The company has shown little interest in what analysts refer to as "generic, PC-based computer networking"—linking PCs to each other.

Improved security

Novell's NetWare captured the lion's share of the network software market in large part because its file-server technology offered improved security for computer data. In earlier network systems, more than one user on the LAN could access the same file at the same time. There was no reliable means to prevent data from being overwritten or destroyed. With NetWare, which controls the network from a server, the operating system arbitrates requests, prohibiting access to a file when it is already open to another network user.

Although NetWare works in conjunction with DOS and DOS-based applications, Novell's operating system long ago broke many of DOS's traditional barriers. NetWare, for example, can access 16 megabytes of RAM, compared with a maximum of 640K under DOS, and up to 256 megabytes on a hard disk, compared with 32 megabytes under DOS versions prior to DOS 4.0.

IMPROVEMENTS IN LAN SOFTWARE WILL SPUR THE DEVELOPMENT OF PROGRAMS THAT ENHANCE GROUP PRODUCTIVITY.

NetWare works with other operating systems as well, including the Macintosh operating system. NetWare support for Unix-based networks is promised for this year. But to date, the product offers only limited support of OS/2 server-based applications.

3Com has been selling its 3Com 3+ network operating system for several years. It is based on MS-Net, a network extension of MS-DOS developed by Microsoft. Like Novell's NetWare, 3+ allows IBM PCs, PS/2s, and Macintoshes to be hooked together. But 3+ has been no match for NetWare, analysts say. The recent arrival of 3+Open LANManager, however, has changed the picture dramatically.

3+Open LANManager offers complete OS/2 support on the server. As a result, 3Com says, its network operating system offers all of OS/2's advantages. These include high-speed resource sharing, easy-to-use graphical interfaces, and notably advanced security—password protection of disk drives and other LAN resources. Most important, 3+Open LANManager permits multitasking on the server, allowing it, for example, to print, retrieve data, and exchange electronic mail all at the same time. And since OS/2 supports DOS, you can still run DOS-based applications at the workstation level. 3+Open LANManager is, in fact, the first network operating system on the market that allows LANs to combine DOS-based PCs with OS/2 servers.

Linked to OS/2's success

The success of 3Com's new LAN software ultimately depends on the success of OS/2. Analysts say that OS/2 will not become the new industry standard for at least two years, when applications that take advantage of the new operating system become available. That may give Novell time to catch up. Still, Hambrecht & Quist's Bradie predicts that 3Com's new LAN operating system will eventually dominate.

Montgomery Securities' Kimball is less certain about 3Com's success. But he believes that 3+Open LANManager will both help OS/2—speeding its acceptance in the corporate world—and be helped by it. Most analysts believe that the switch from DOS to OS/2 is inevitable and that OS/2 can only increase sales of 3Com's product.

There are skeptics, however. One of them is Douglas Gold, manager of computer communications research at International Data Corp. (IDC), a market research firm in Framingham, Mass. Gold calls 3Com's headlong rush into OS/2 "a questionable strategy."

3Com, Gold says, must play an evangelical role for the next 12 to 18 months, "pushing the advantages of OS/2 and 3+Open LANManager down the throats of corporate America." But users, he continues, are looking for something that works today.

Whoever wins, the resulting improvements in LAN software seem certain to spur development of applications tailored to enhance group productivity. Most major software companies, including Lotus Development Corp., are working on such programs, known broadly as groupware.

In addition to producing groupware programs, all the leading software companies are expected to adapt their most popular products for network use. And, analysts believe, many applications not currently available on networks—scheduling programs, for example—will be introduced.

"In any new marketplace, there's a terrific opportunity to provide products that don't exist," says IDC's Gold. "Expect to see a flood." *—Steve Stecklow*

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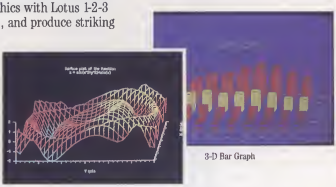

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WHERE ARE THE OS/2 APPLICATIONS?

They're coming, but don't hold your breath.

In April 1987 Microsoft and IBM announced OS/2, and the first prerelease OS/2–Presentation Manager Software Development Kit shipped to software developers. Now, two years later, you might reasonably ask, When will new OS/2 applications hit my desk? Not OS/2 ports of popular DOS programs, but built-from-the-ground-up applications that run under Presentation Manager (OS/2's graphical interface) and use OS/2's superior memory-management and multitasking capabilities.

The answer is, Maybe next fall.

It takes about 18 months to develop new applications, says Nancy McSharry, senior PC software analyst for International Data Corp. (IDC), a market research firm in Framingham, Mass. That means OS/2 product announcements should begin this spring, she says, and some products may be delivered this fall.

With so few applications, OS/2 isn't selling as well as IBM and Microsoft had hoped. According to IDC estimates, only 65,000 copies of OS/2 with Presentation Manager were delivered to dealers in 1988. But IDC predicts that about 124,000 copies will ship worldwide this year, and 3 million copies will ship in 1992.

Imminent announcements

So far, says Mark Mackaman, Microsoft's product manager for OS/2, at least 50 Presentation Manager applications will ship this year. "Several are about to be announced," he says, and one, Borland International Corp.'s *SideKick for Presentation Manager*, is ready to ship.

In any case, 50 applications is a far cry from the 1,000 or so that IBM predicted would be available by the end of 1988. In part, the delay can be attributed to the several iterations and revisions of OS/2 and Presentation Manager. For example, last October's release of OS/2 Standard Edition Version 1.1 contained only one printer driver—for IBM's 4201 Proprinter, a 9-pin dot-matrix printer. A supplemental disk with more printer drivers didn't ship until this February.

North Winds, a software company in Greensburg, Pa., found that the Presentation Manager that arrived with OS/2 last October was not the same as the Presentation Manager in the first development kit. "We worked with the early version of Presentation Manager," says Randy Krofick, president of North Winds, "but there were a lot of problems."

In fact, North Winds decided not to release the first OS/2–Presentation Manager versions of its *Formz* and *Formall* forms-processing programs because of bugs. North Winds says it received an improved version of Presentation Manager in late January, and Krofick believes both forms-processing programs will be released shortly.

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John Neering, president of Computer Aided Planning (Grand Rapids, Mich.), which writes facilities-planning software and publishes databases on CD-ROM, also blames Microsoft's revisions for delaying his firm's Presentation Manager applications. "After 18 months of development," says Neering, "the latest revisions will make us revise for a third time."

Writing and rewriting applications is easier for developers whose programs already run under *Microsoft Windows*. Ken Shain, president of Geovision, a software firm in Norcross, Ga., says that people who have programmed for *Windows* are already familiar with the modular programming technique that Presentation Manager requires.

For example, Shain estimates that 50% of the code for Geovision's *Windows/On the World*, a *Windows*-based mapping program that supports Geovision's line of CD-ROM–based atlases, can be plugged directly into a Presentation Manager version of the same product. However, Shain says that Geovision expects some further revisions to Presentation Manager and will confirm only that the OS/2 version of *Windows/On the World* will ship "sometime this year."

Even if OS/2–Presentation Manager applications were available now, the hardware needed to run them is still expensive. To take full advantage of OS/2 and Presentation Manager, says Bruce Stephen, a senior PC analyst for IDC, you need an 80386 or 80386SX computer with a lot of memory. Estimates of the memory required vary widely. For the typical configuration, Microsoft says 3 to 4 megabytes, Lotus Development Corp. says 4 to 6, and some users say 10 to 12.

When hardware prices come down and OS/2 applications arrive, users still may not migrate to them en masse. Many people don't need a memory-hogging graphical interface and graphical-based software, IDC's McSharry points out. And, she adds, changing operating systems is always dangerous. Aside from the risk of data loss or damage during the changeover, a company must allow for the learning process that follows.

Even the head of IBM's PC division, James Cannavino, reports *The Wall Street Journal*, finds installing OS/2 a daunting task.

In fact, the world of PC users has not been screaming for Presentation Manager. "People aren't dealing with OS/2 yet," says Abraham Poznanski, president of the Micro Products Division of Computer Associates International (San Jose, Calif.). "Most microcomputer managers say it's the direction they're heading in," he says, "but they're not there yet."

—Dana Blankenhorn

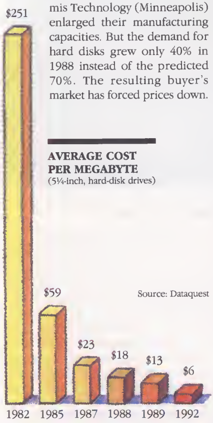
HARD-DISK CAPACITIES SOAR, PRICES DROP

And 3½-inch drives are the new standard.

Despite new mass-storage technologies, such as CD-ROM and erasable optical disks, the hard disk remains the PC's data-storage workhorse. Hard-disk capacities are soaring, prices are falling, and sales are setting new records, with 3½-inch drives overtaking their larger, 5¼-inch counterparts. According to market research firm Dataquest (San Jose, Calif.), some 10 million hard disks were sold last year.

The cost of hard-disk storage has fallen precipitously in the past two years. Last year the price was about $18 per megabyte; today it's down to $13 per megabyte, and Dataquest estimates a more than 50% drop to $6 by 1992 (see graph below).

Phil Devin, senior industry analyst at Dataquest, attributes the most recent downward price trend to "severe manufacturing overcapacity." Expecting a huge increase in PC sales, drive makers such as Seagate Technology (Scotts Valley, Calif.), MiniScribe Corp. (Longmont, Colo.), and Imprimis Technology (Minneapolis) enlarged their manufacturing capacities. But the demand for hard disks grew only 40% in 1988 instead of the predicted 70%. The resulting buyer's market has forced prices down.


AVERAGE COST PER MEGABYTE
(5¼-inch, hard-disk drives)

Source: Dataquest

The increasing price competition from hard-disk drives has especially hurt the market for hard-disk cards, which were already suffering somewhat from a reputation for failure. In fact, the hard card—a hard-disk drive and controller combined on a PC expansion board—may become hard to find. Over the last few months, several hard-card makers, including Verbatim (Charlotte, N.C.) and Mountain Computer (Campbell, Calif.), have discontinued some of their hard-card products.

Today's drives don't operate much differently from the washing-machine-size drives that IBM developed in the late 1950s and early 1960s for its mainframes. They still rely on hard metal disks coated with magnetic material. The record/play heads, much like those used in tape recorders, "float" above the disk, writing and reading data to and from the magnetic surface.

Smaller is better

Today's drives differ from those of old in several important ways, however. Not only are they less expensive, but they are

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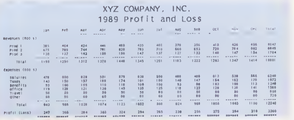
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smaller and faster as well. And if the analysts are right, hard-disk drives will get even smaller. More compact PCs such as IBM's PS/2 line, as well as a burgeoning laptop computer market, are driving the demand for 3½-inch drives. Today, manufacturers can pack 30 to 100 megabytes into the smaller drives. In an industry where smaller is perceived as better, analysts expect 3½-inch drives to become the standard.

David Vellante, director of storage research for International Data Corp. (Framingham, Mass.), predicts that sales of 3½-inch drives will exceed 7 million this year, overtaking sales of 5¼-inch drives. IDC estimates U.S. sales for 1988 at 4.2 million 3½-inch drives and 4.6 million 5¼-inch drives.

Today's average corporate user, says Vellante, has close to 40 megabytes of hard-disk capacity. Corporate workstation users have even more. Dataquest estimates a current 70-megabyte average for workstations and predicts that average will increase 250% by 1990 and nearly 500% by 1992.

Megabytes to gigabytes

In October 1988 Imprimis Technology announced its Wren VII, a 5¼-inch, hard-disk drive with a capacity of 1.2 gigabytes (1200 megabytes). The drive is not expected to be available in production quantities until the end of this year, but it will rival erasable optical disks, which also promise gigabytes of storage. Until then, check out the read/write magneto-optical drive (manufactured for the Next machine by Canon USA) recently introduced in Steve Jobs's Next Computer System. The optical drive stores 512 megabytes on a double-sided, 5¼-inch optical disk housed in a removable cartridge.

But the question remains: Who needs that much storage space? People who don't need or can't afford huge-capacity drives can get a 20-megabyte drive for a current street price of about $300. And John Dunkle, vice president of Work-Group Technologies, a consulting firm in Hampton, N.H., expects that price to bottom out at close to $200 by 1990. However, industry experts agree that for users of graphics packages, with their storage-hungry files, and for those who use multiple applications for different jobs, increased hard-disk capacity is practically a requisite.

Lots of storage has a down side, Dunkle notes. When space is limited, people have no choice but to delete unneeded files and organize their directories. Dunkle fears that unlimited storage may encourage negligence of hard-disk housekeeping chores. And, he adds, some users may learn the hard way about catastrophic data loss if the increased backup time (up to an hour for an 80-megabyte drive) causes them to forgo regular data backup. *—Stan Miastkowski*

DEC MOVES INTO DESKTOP COMPUTING

As yet, though, no threat in the PC market.

Is Digital Equipment Corp. becoming a major player in desktop business computing? Not exactly, say analysts, despite DEC's late-winter announcements of several competitively priced machines and what the firm calls "the industry's most comprehensive systems for the desktop."

In the workstation arena, the nation's number two computer maker will be a fierce competitor. Analysts rate DEC's new RISC (reduced instruction set computing) machine, the DECstation 3100, as clearly a leader in its price class. But DEC says that, for the moment, it does not intend to go after a major part of the personal-computer market.

In addition to its new RISC model, DEC will offer several new workstations based on its immensely successful VAX architecture and either its proprietary VMS operating system or Ultrix, DEC's version of Unix. The group includes an entry-level model, called the VAXstation 3100, that starts at a PC-like price of $7,950.

DEC also confirmed, as expected, that it would sell a line of IBM PC–compatible computers made by Tandy Corp. To unify its product lines, DEC said it would offer both its *DECwindows* graphical user interface and MS-DOS emulators. The emulators will allow VMS-based machines to run PC-based software.

Of all the announced products, says Kathleen Hurley, an analyst with market research firm Dataquest (San Jose, Calif.), "the RISC machine is the most significant." With a base price of less than $12,000, the DECstation 3100 delivers a processing speed about 10 times greater than the speed of an IBM PC AT or an Apple Macintosh II. That makes it a direct competitor to similar Unix-based RISC machines that workstation leader Sun Microsystems currently sells for several times as much.

The DECstation is also a challenge to the PC industry, says Hurley, because it further blurs the distinctions between high-end PCs and workstations. Over the long run, she says, "low-end workstations could compete with high-end PCs." There's already some overlap, she points out. Sun makes an 80386-based Unix workstation, while Apple and IBM are developing versions of Unix for their high-end PCs. Workstations, once used exclusively for engineering applications, are also beginning to compete with personal computers in financial, modeling, and other commercial applications. Meanwhile, PCs are showing up in engineering and electronic design.

The RISC-based DECstation 3100 delivers a processing speed of about 12 million instructions per second.

Even John Rose, DEC's group manager for personal-computing systems, admits that workstations and PCs are looking increasingly similar. But Rose emphasizes that for technical tasks, workstations usually have better software than PCs, as well

Digital's DECstation 386 is an IBM PC–compatible made by Tandy Corp.

as a better support network.

DEC has never been a strong presence in the PC marketplace. PC analysts say that despite DEC's size—it is larger than Microsoft, Apple, and Compaq combined—DEC will be the underdog in any effort to establish a presence in that market. Compared with smaller PC firms, "DEC is just too slow to react to the constantly changing PC market," says Jeffrey Tarter, editor and publisher of *Softletter*, an industry newsletter based in Cambridge, Mass.

Rose admits that his company "is not going to hit every person in the street who wants a personal computer." DEC's strength, he says, lies in integrating the customer's hardware and software into local and wide area networks.

Within that large niche, agrees *Softletter*'s Tarter, DEC may have a chance. But Apple, Compaq, and IBM's PC division needn't worry just yet. Given the current arrangement, concludes Tarter, "DEC can't sell a mass-market computer."

—Steve Rosenthal

CHIP SHORTAGE OVER

And hardware prices drop.

The memory-chip shortage is now all but over. Hardware manufacturers agree that memory chips are both less expensive and more available. With chip prices falling since September, you may even see the benefits in your next computer purchase.

As early as last August, the computer maker Wyse Technology dropped the prices of some products; three months later, printer maker QMS followed suit, both companies citing lower DRAM prices. In December, Dell Computer Corp. began charging $200 less for an 80386 system with 1 megabyte of memory and $1,000 less for a 4-megabyte system. At the same time, Northgate Computer Systems dropped prices on 1- and 4-megabyte memory upgrades for its systems. And computer manufacturer Micro Express is now offering some systems with twice the memory for the same price.

On the other hand, at press time, Compaq Computer Corp. and some other major players had yet to pass along DRAM savings. But Compaq spokeswoman Debra Globe says that if chip prices continue to fall, Compaq "will consider some product repricing."

Supply meets demand

In-Stat, a market research firm in Scottsdale, Ariz., predicts that supply will meet demand by midyear. By year end, says Zohar Raz, In-Stat's vice president of technology, 1-megabit DRAM prices should be $6 to $10, depending on the strength of the PC market. That's about a 50% drop from last year's average of $15 worldwide and $20 in the United States. In addition, delivery lead time for memory chips has dropped from a high of fourteen weeks to eight weeks, says Doug Andrey, manager of industry statistical programs with the Semiconductor Industry Association.

Last year's shortages, says Raz, occurred mainly because chip makers switched their production from 256-kilobit chips to 1-megabit chips in late 1987. Switching to a new chip isn't like bringing out a new-model car, says Andrey. "It takes time to get it right."

In a good production run, 7 or 8 out of every 10 chips are good and salable, but when production of a new chip begins, those yields drop dramatically. At the height of last year's shortage, analysts estimate, only 1 out of 10 1-megabit chips could be used. Production yields increase as manufacturing processes are refined, however, and In-Stat expects the supply of 1-megabit chips to reach 540 million this year, up almost 200% from last year's 185 million. Raz estimates that Japan will produce 80% of the 1-megabit chips in 1989, the United States will produce 12%, and the balance will come from Korea.

The demand for these chips is increasing almost as fast as the supply. Many consumer products, such as video recorders, depend heavily on memory chips. And new products, such as high-definition TVs, will increase the demand even more. In fact, says Weldon Knape, marketing manager for general memories at Motorola (Austin, Tex.), computers now represent only 50% of the demand for memory chips, down from 70% to 80% a few years ago. With a steady supply, he says, memory-chip prices may fall as low as $5 to $8 by year end.

There's always a lag between the time prices fall at the manufacturer level and when you see lower prices at the retail level. Nonetheless, memory chips are normally a cutthroat market. When there's an adequate supply, says Bill Kirwin, program director for the Gartner Group, a market research firm in Stamford, Conn., "all it takes is one guy with a sales quota to meet to send prices tumbling down."

—Dana Blankenhorn

MORE @FUNCTIONS FOR 1-2-3

A growing number of add-ins for streamlining calculations

Even though *1-2-3* Release 2.01 is more than two years old, software developers continue to release programs that enhance Lotus Development Corp.'s market-dominant spreadsheet. Programs that add new @functions to the 90 or so that are already in *1-2-3* and *Symphony* are especially the rage.

"I'm not surprised," says Tony Hatoun, president of Intex Solutions, a software firm in Needham, Mass. "Our customers say a well-designed @function can, in one cell, do the job of a large, memory-hogging macro—sometimes faster." He adds, "It's easier to reference the necessary cells within a formula than within a macro, particularly if your spreadsheets are less-than-perfectly organized."

An @function is essentially a series of arithmetic calculations combined into a single statement. @Functions are one way to streamline the formulas or processes you use the most.

If you keep a close watch on your investment portfolio, for example, you may be interested in either *Bond Yield Calculations* ($595, from Intex Solutions) or *@Fixed_Income* ($795, from Spreadsheet Solutions Co., Garden City, N.Y.).

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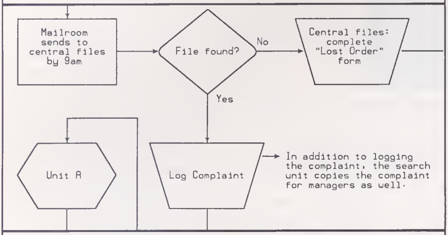
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These add-ins for *1-2-3* and *Symphony* give you 20 and 44 @functions, respectively, that calculate bond prices and yields for both domestic and foreign securities. And they can calculate regular and irregular periods, odd-coupon and zero-coupon bonds, Treasury notes, and more.

The 20 financial @functions for *1-2-3* in *Financial Toolkit* ($99, from S. B. Associates, Wayland, Mass.) can calculate variable interest rates and payments, even and uneven periods, and nominal and effective yields. The depreciation @functions reflect the rules outlined in the Tax Reform Act of 1986.

Project Calc ($179.95, from Frontline Systems, Palo Alto, Calif.) gives *1-2-3* and *Symphony* 30 new @functions for project budgeting and scheduling, and *@Risk* ($395, from Palisade Corp., Newfield, N.Y.) gives *1-2-3* another 30 @functions specifically for risk analysis and Monte Carlo simulation.

For statisticians, market researchers, and forecasters, *@Stats* ($295, from Intex Solutions) supplies *1-2-3* and *Symphony* with 44 new @functions for calculating linear regression, linear interpolation, skewness, kurtosis, integrals, and other statistical values.

If your @function wish list is less specific, *@Functions#1* ($95, from Intex Solutions) is a collection of 45 financial, string, logical, date and time, lookup, and calendar @functions for *1-2-3* and *Symphony*. And *@Library* ($79.95, from IRG Information Systems, Setauket, N.Y.) gives *1-2-3* and *Symphony* 48 new @functions for statistics, finance, economics, and template development.

Finally, if your @function collection is still incomplete, *3-2-1 Gosub* ($99.95, from Frontline Systems) not only provides 48 new @functions for *1-2-3*, it lets you create your own. You can even create @functions that invoke the @functions in other add-ins. *—Jennifer Smith*

ARE COMPUTER GAMES GETTING TOO VIOLENT?

You may want to check the ratings.

The technology that has brought new depth and sophistication to business presentations has also produced computer games so chillingly explicit that a few electronic-entertainment publishers now label some of their products with ratings

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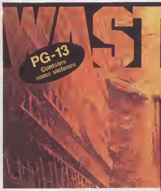


Electronic Arts' *Wasteland* adventure game carries a PG-13 label.

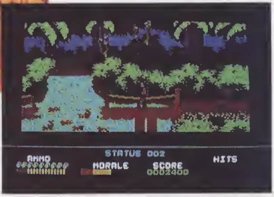
similar to those the motion-picture industry assigns to movies. Electronic Arts (San Mateo, Calif.), for example, puts a PG-13 sticker on its *Wasteland* adventure game, along with these few words of warning: "Contains some violence."

These products are not the traditional shoot-down-the-aliens games. For example, *Platoon*, from Data East USA (San Jose, Calif.), contains most of the violence of the film on which it is modeled, but it has none of the film's redeeming social commentary. In the computer-game version, you lead your platoon into jungles, villages, bunkers, and underground tunnels in Vietnam. You encounter guerrilla fighters, snipers, trip wires, armed patrols, and napalm air strikes. "At times, the odds may seem insurmountable," Data East's promotional copy states. "But don't think about winning—to survive is enough."

In *Manhunter: New York*, a computer game from Sierra On-Line (Coarsegold, Calif.), victims' simulated brain tissue splatters across your computer screen in high resolution and vivid color.

"There are a few products on the market that I find offensive," says Bob Lindstrom, who is the video games columnist for *Omni* magazine, as well as the editor of *A+*, a magazine oriented toward family and school users of Apple II computers. But Lindstrom doesn't think that such products are really cause for alarm. He says, "I question whether they are a menace to public health."

On the other hand, David Grady, editor and publisher of the education-oriented *Grady Report* newsletter, says that it's a mistake to ignore the possibility that violent games produce violent behavior. "You can't take the position that art can have a good effect," he says, "without admitting the possibility that it can have a bad effect." Grady concedes, however, that violent games may provide an escape valve for intense emotions rather than cause hostile behavior.



Snipers, trip wires, and napalm air strikes are among the hazards that await you in *Platoon*, from Data East.

Finding a definitive answer won't be easy. "If the research hasn't been done already, it probably won't be done," says Geoffrey Loftus, a professor of psychology at the University of Washington and coauthor of *Mind at Play* (Basic Books, 1983), a book about video games. Loftus says such a study would need to include large numbers of computer-game players and their non-game-playing counterparts. "But," says Loftus, "it's getting hard to find anyone who hasn't played computer games." *—Steve Rosenthal*

ANIMATION COMES TO PERSONAL COMPUTERS

Add motion to your graphics and meaning to your designs.

PBS's *Nightly Business Report* opens with a montage of moving blue grids, floating green continents, and a flying pink satellite. The segment was created by computer animators at WPBT2/Miami, using a Compaq Deskpro 386 and *PictureMaker* software from Cubicomp (Hayward, Calif.). In fact, 60% to 65% of the more than 3,200 systems used to produce commercial animation are PC-based, according to the 1988 *Roncarelli Report*, an analysis of the animation market, published in Toronto.

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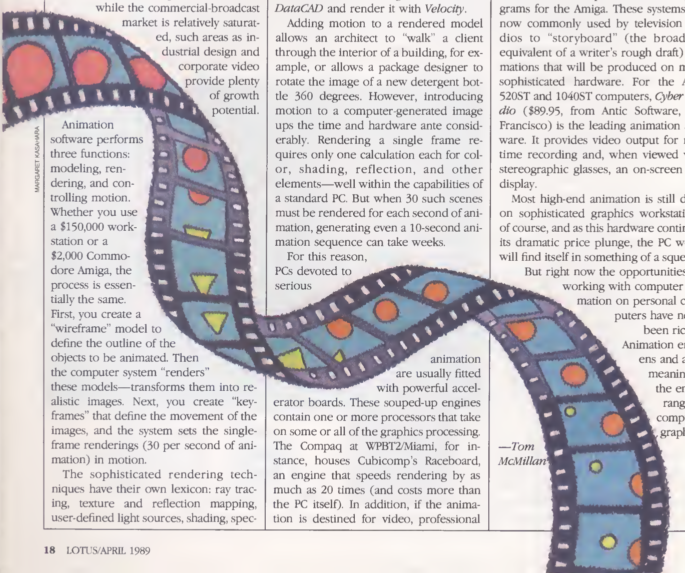
animated images that rival the best output of yesterday's supercomputers. Computer animation has given engineers, architects, designers, scientists, doctors, and communications specialists a new tool for conveying ideas, troubleshooting problems, and simulating designs. And sales of animation systems are growing. From 1987 to 1988, system sales increased by more than 40%, from $565 million to $801 million, according to the *Roncarelli Report*.

"The tremendous growth is in PC-based systems," says publisher and editor Robbie Roncarelli. Market analysts don't track growth in PC-based animation specifically, but John Gantz, executive vice president of Technology Financial Services (Westford, Mass.), believes that the market for PC-based animation software is growing by 15% to 20% annually. Doug Harrison, product marketing manager at Cubicomp, claims sales of *PictureMaker* are increasing at a 20% to 30% annual clip. And most pundits agree that while the commercial-broadcast market is relatively saturated, such areas as industrial design and corporate video provide plenty of growth potential.



MARGARET KASAHARA

Animation software performs three functions: modeling, rendering, and controlling motion. Whether you use a $150,000 workstation or a $2,000 Commodore Amiga, the process is essentially the same. First, you create a "wireframe" model to define the outline of the objects to be animated. Then the computer system "renders" these models—transforms them into realistic images. Next, you create "keyframes" that define the movement of the images, and the system sets the single-frame renderings (30 per second of animation) in motion.

The sophisticated rendering techniques have their own lexicon: ray tracing, texture and reflection mapping, user-defined light sources, shading, specularity, and the like. These techniques produce lifelike images that are useful, for example, as electronic prototypes. They enable designers to test a concept or make a presentation to a client without having to break out the foam-core board and create a physical model.

Animation plus CAD

To complement this use of animation techniques, many of today's PC-based systems accept models created in standard computer-aided-design (CAD) packages. Cubicomp's *PictureMaker*, for instance, can take a wireframe model created on the PC with *CADKey* software and apply its rendering techniques to dress up the model with uncanny realism. Similarly, Microtecture (Charlottesville, Va.) and Circuit Studios (Bethesda, Md.) have worked together to integrate Microtecture's *Velocity* rendering program with Circuit's *DataCAD* and *DC Modeler* software. The combination will allow architects to design a structure in *DataCAD* and render it with *Velocity*.

Adding motion to a rendered model allows an architect to "walk" a client through the interior of a building, for example, or allows a package designer to rotate the image of a new detergent bottle 360 degrees. However, introducing motion to a computer-generated image ups the time and hardware ante considerably. Rendering a single frame requires only one calculation each for color, shading, reflection, and other elements—well within the capabilities of a standard PC. But when 30 such scenes must be rendered for each second of animation, generating even a 10-second animation sequence can take weeks.

For this reason, PCs devoted to serious animation are usually fitted with powerful accelerator boards. These souped-up engines contain one or more processors that take on some or all of the graphics processing. The Compaq at WPBT2/Miami, for instance, houses Cubicomp's Raceboard, an engine that speeds rendering by as much as 20 times (and costs more than the PC itself). In addition, if the animation is destined for video, professional animators use a sophisticated controller that links a videotape recorder to the computer so that signals are synchronized and each frame is recorded at the right spot on the tape.

But if you can get by without broadcast-quality video or the ultimate in realistic effects, PC-based animation software is quite affordable. If creating realistic but static renderings of CAD designs is the goal, IBM PC programs like *AutoShade* ($500, from Autodesk, Sausalito, Calif.) or *ModelMate* ($349, from Control Automation, Altamonte Springs, Fla.) fill the bill. For the Apple Macintosh II, *ModelShop* ($495, from Paracomp, San Francisco), or one of the *Dimensions* programs ($295 to $1,495, from Visual Information, La Puente, Calif.) can do a fine job of rendering complex objects.

Other low-cost animation software runs on inexpensive Amiga and Atari PCs. Byte by Byte Corp. (Austin, Tex.) and Aegis Development (Santa Monica, Calif.) have both developed under-$500 programs for the Amiga. These systems are now commonly used by television studios to "storyboard" (the broadcast equivalent of a writer's rough draft) animations that will be produced on more sophisticated hardware. For the Atari 520ST and 1040ST computers, *Cyber Studio* ($89.95, from Antic Software, San Francisco) is the leading animation software. It provides video output for real-time recording and, when viewed with stereographic glasses, an on-screen 3-D display.

Most high-end animation is still done on sophisticated graphics workstations, of course, and as this hardware continues its dramatic price plunge, the PC world will find itself in something of a squeeze. But right now the opportunities for working with computer animation on personal computers have never been richer. Animation enlivens and adds meaning to the entire range of computer graphics.

—Tom McMillan

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Expandability	Very Good	Satisfactory
Documentation	Very Good	Good
Setup	Good	Satisfactory
Ease of use	Good	Satisfactory
Serviceability		
Workmanship	Very Good	Satisfactory
Support policies	Good	Excellent
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Value	Very Good	Satisfactory
Final scores	**7.4**	**5.6**

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LABELING THE WORKSHEET

Words add meaning to the numbers and formulas in your worksheets.

BY DANIEL GASTEIGER

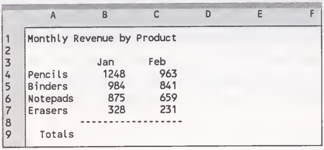
A *1-2-3* worksheet lets you store numbers and perform calculations. To help you identify the meanings of the numbers and formulas you enter, *1-2-3* lets you enter words to label the entries.

In the previous installment of this column, we entered some numbers into a spreadsheet and created a few simple formulas. This month's installment shows you how to create labels so that you can make your worksheet entries easy to understand.

NUMBERS OR LABELS

A label can consist of any characters available on your computer's keyboard and others that we'll cover in a later column. In most cases, a label is a word or words describing the contents of a nearby cell. For example, the entries in column A and in row 3 of the following worksheet are labels that identify the contents of cells B4, B5, B6, B7, C4, C5, C6, and C7. Let's create the worksheet and use it to explore the difference between values and labels.

Immediately after you load *1-2-3*, move the cell pointer to cell A4. To enter the word *Pencils*, begin by typing the letter P. Notice that when you press the P key, the letter P appears on the edit line of the control panel. Also, the Ready mode indicator in the top-right corner of the display changes to reveal that you're entering a label. Whenever you start a cell entry by typing a letter, *1-2-3* assumes that you're entering a label.



```
      A         B         C         D         E         F
1  Monthly Revenue by Product
2
3              Jan       Feb
4  Pencils     1248       963
5  Binders      984       841
6  Notepads     875       659
7  Erasers      328       231
8          -----------------
9    Totals
```

Finish typing the word *Pencils*, then press Return. The word *Pencils* appears in cell A4, and *1-2-3* returns to Ready mode. As long as the cell pointer resides in a cell, *1-2-3* displays the cell's contents in the top-left corner of the display. When you look there now, the current cell address appears, followed by a colon, an apostrophe, and the word *Pencils*.

You didn't type an apostrophe when you entered *Pencils*, yet *1-2-3* shows an apostrophe as part of the cell's contents. The apostrophe is a label-prefix character.

To contrast the label entry with a numeric entry, move the cell pointer to cell B4 and enter the number shown in the worksheet figure. Notice that when you type the number's first digit, *1-2-3* recognizes that you're typing a value and changes the mode indicator accordingly. *1-2-3* accepts the entry as you type it; no label prefix appears after the current-cell indicator in the control panel.

Here's the simple rule: *1-2-3* stores numbers exactly as you enter them, but every worksheet label begins with a label prefix. The prefix doesn't actually appear in the spreadsheet, but it is an integral part of a cell's contents. In most cases, *1-2-3* inserts a label prefix automatically

← CIRCLE 116 ON READER SERVICE CARD

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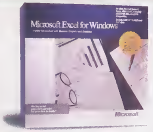

As the PC industry moves rapidly toward graphical environments, you're faced with a crucial decision: To choose the graphical spreadsheet that's emerging as the industry standard. Or to continue

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START HERE *continued from page 21*

when you start typing a label. But you can start any label entry by typing the prefix character yourself.

To see how this works, move the cell pointer to cell A5 and type an apostrophe. Be sure to select the apostrophe that shares a key with the quotation mark. Now type the word *Binders* and press Return. The label appears in the cell, as shown in our worksheet. In the control panel, *1-2-3* displays the entry preceded by a label prefix.

Move the cell pointer to cell A6 and enter the label *Notepads*, then move the pointer to cell A7 and enter *Erasers*. You decide in each case whether you wish to type the label prefix before typing the rest of the label.

WHY PREFIXES?

The most important use for label prefixes is in determining how *1-2-3* positions a label in its cell. The apostrophe label prefix that *1-2-3* automatically supplies when you create a label indicates that the label should appear left-aligned, that is, begin at the left edge of the cell.

There are two other prefix characters that control a label's alignment. The quotation-mark label prefix right-aligns a label; the caret (^) centers a label in the cell.

Move the cell pointer to cell A9 and type a quotation mark, then type *Totals* and press Return. This new entry isn't flush left with the previous entries. It aligns with the right side of the cell. And you can see in the control panel that *1-2-3* did not insert an apostrophe before the entry. By starting the entry with a valid label prefix, you override the default, or built-in, prefix.

The entries in cells B3 and C3 are centered. Move the cell pointer to cell B3 and type a caret (it shares a key with the 6 on the top row of your keyboard), then type *Jan* and press Return. Move the pointer to cell B4 and enter *^Feb*. Then, so that your worksheet matches ours, enter the remainder of the values in columns B and C.

Your simple practice worksheet is almost complete. Before you enter the worksheet's title, there's another label prefix that you'll find useful in almost every spreadsheet you create. The backslash (\) prefix character indicates to *1-2-3* that whatever characters follow should appear across the entire width of the cell.

We've used the backslash label prefix to create the dividing lines in cells B8 and C8. To do this, move the cell pointer to cell B8 and type a backslash. Note that this is *not* the slash that appears on the same key as the question mark. Then type a single minus sign, which shares a key with the underline, and press Return.

In the control panel, *1-2-3* displays the cell's contents as you entered them: a backslash followed by a minus sign. However, in cell B8 the entry appears as nine minus signs. Move the cell pointer to cell C8 and enter a backslash and a minus sign the same way.

1-2-3 can repeat any character or characters across the width of a cell. You'll probably use the minus sign and the equal sign most often, but experiment on your own with other characters and see how the backslash can reduce your efforts in enhancing a worksheet's appearance.

Now, what about that title at the top of the worksheet? Each label we've entered so far has nine or fewer characters. The title in row 1 of our illustration has 26 (even the space between two words counts as a character).

To create the title, enter the complete phrase in cell A1: Move the cell pointer to cell A1 by pressing the Home key, type *Monthly Revenue by Product*, and press Return.

Even though the entire label resides in cell A1, *1-2-3* displays the extra characters overlapping cells B1 and C1. There are no characters in cells B1 and C1. You can prove this by moving the cell pointer to the right and observing the current-cell indicator in the control panel.

If you were to make an entry in cell B1, *1-2-3* no longer would display all of the label in cell A1. If you haven't done so, move the pointer to cell B1. Then enter the number 8. Suddenly cell A1 appears to contain only the label *Monthly R*. Cell A1 still contains the entire label as you entered it, but *1-2-3* assumes that you want to see the information stored in cell B1. In a sense, the contents of cell B1 cover the balance of the label in cell A1. You can uncover cell A1's label by erasing cell B1—a task that we'll leave for a future discussion. ■

WHAT IF YOU MAKE AN ERROR?

No one is perfect. Chances are that you'll make mistakes when you type entries in the worksheet. Fortunately, you don't have to live with the errors.

If you hit a wrong key while typing a label or a value, press the Backspace key. The Backspace key, at the right end of the keyboard above the Return key, is often denoted by an arrow pointing to the left. The erroneous character will vanish, and you can continue typing.

If you discover your error after you've pressed Return and committed your entry to a cell, you have two options. You can either retype the entry and reenter it, or you can edit the existing entry.

To learn how to edit an entry, move the cell pointer to cell A15 and enter the label *This lable has two misteaks*. After you press Return, press the EDIT key. You can identify the EDIT key by its listing on the function-key template that came with your *1-2-3* package. The EDIT key on most computers is the F2 function key.

When you press the EDIT key, *1-2-3* redisplays the label, immediately followed by the cursor in the edit line of the control panel. Press the LeftArrow key (not the Backspace key) to move the cursor directly under the second S in *misteaks*. Then type the letter E. *1-2-3* enters the E to the left of the cursor.

Now move the cursor left so that it falls under the first E in the word. Press the Delete key on the numeric keypad to erase the E. Correct the second error by moving the cell pointer to the E in the word *lable* and pressing the Delete key. Then move the cursor left one character, type an E, and press Return. *1-2-3* enters the corrected label into the current cell.

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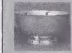

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1-2-3 MACROS

WHEN YOUR DATABASE OUTGROWS RAM

Sophisticated techniques let you create a disk-based data system in *1-2-3*.

BY NICK DELONAS

A database in *1-2-3* works at high speed because it resides entirely in RAM. Unfortunately, you can put only so much data in a *1-2-3* database before that nasty MEM warning indicator appears. To avoid that problem, you may choose to buy more memory—and probably a plug-in board to hold it. Or you may choose to switch to a stand-alone database program, such as *Q&A*, *dBase*, or *Paradox*.

Another alternative, however, is less costly and lets you retain the worksheet environment. You can create a *1-2-3* Release 2/2.01 database that, for the most part, remains on disk. Your worksheet in RAM contains a data-entry form that you use to add records. It also contains a compact index to the records in the stored database.

The key is the database index. This article will show you how to set up an index and, with the help of three macros, use it to drive a sample disk-based database. You will end up with a template for a disk-based database of your own. You will also gain expertise in handling the macro commands related to file management.

PLUSES AND MINUSES

Before we go further, let's consider more closely whether you should adopt the index approach to your database.

You may have little choice if your database contains thousands of records or if each record is very large. You may run out of RAM. In contrast, the procedure described in this article will accommodate up to 8,190 records, the limit of available rows in a worksheet. With a more complex macro, you could overcome that limit by continuing the index into another set of worksheet columns, although the amount of memory available will eventually become a factor.

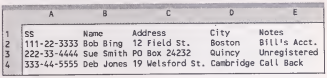
Moreover, the index you will learn to produce here is flexible only up to a point. Since it is itself a database, you can manipulate it with various Data Sort and Data Query commands, although we will not cover these techniques in this article.

The index approach described here has limitations. The most important is that you can view only one complete record at a time. Also, while you can delete records and create modified ones, the old records remain in the disk file, taking up space. A macro that would "pack" the file—that is, remove deleted records—as stand-alone database programs do, is beyond the scope of this article.

So if your database will fit in RAM, you ought to keep it there.

THE DATABASE INDEX

Figure 1 shows a typical database as you would create it in *1-2-3*. Each row of range A2..E4 contains a single record. The labels *SS, Name, Address, City*, and *Notes* identify the record's fields. For example, the *SS* field of the first record contains the label *111-22-3333*, representing a Social Security number.



```
          A           B          C               D         E
1  SS          Name       Address         City      Notes
2  111-22-3333 Bob Bing   12 Field St.    Boston    Bill's Acct.
3  222-33-4444 Sue Smith  PO Box 24232    Quincy    Unregistered
4  333-44-5555 Deb Jones  19 Welsford St. Cambridge Call Back
```

FIGURE 1

As noted earlier, a database index is itself a small database. It is analogous to the card catalog in a library. A database index must contain a key field. Just as a Dewey decimal number uniquely identifies each book in a library, so the key field uniquely identifies each record in the disk-based database file. In the sample database that we'll create, *SS* will be the key field. There's no chance of duplicate Social Security numbers.

Some databases have no obvious key field. One solution is to assign a unique record number to each record. That requires a program routine that suggests or assigns a number not in use.

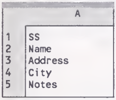
A database index must also contain a field that lists the location of each record in the disk-based database—just as a library's catalog card tells the location of the book in the stacks. And like a catalog card, a database index may contain other fields to help you select the right record. In our sample index, we'll include a field for the person's name.

We don't need any more fields in our index, so we will not need RAM to store the data from the *Address, City*, and *Notes* fields.

THE MODEL

To follow this discussion, first build the worksheet as explained in the setup box on the page opposite.

The template you create works with a simple database. The field names are the labels shown in range A1..A5 in figure 2 below. These labels are also the range names for the cells in range B1..B5. You will enter data into range B1..B5 that a macro will later store in the disk-based database. Another macro will use the same range to display a record retrieved from the disk.

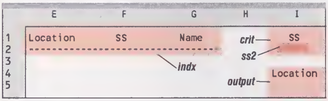


```
     A
1    SS
2    Name
3    Address
4    City
5    Notes
```

FIGURE 2

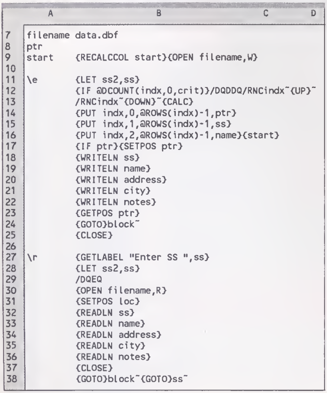
The database that is the index to the disk-based database will reside in columns E, F, and G, as indicated in figure 3 below.

The labels in range E1..G1 are the index's field names. The *Location* field of each record in the index will contain a number that represents the exact byte location of the corresponding record in the disk database file. The key field, *SS*, will contain the Social Security number in that disk record, and the *Name* field will contain the name in that disk record.



```
     E              F              G             H         I
1    Location       SS             Name                    SS
2    ------------------------------------
3
4                                                          Location
5
```

FIGURE 3



```
     A                B                                        C        D
7    filename data.dbf
8    ptr
9    start    {RECALCCOL start}{OPEN filename,W}
10
11   \e       {LET ss2,ss}
12            {IF @DCOUNT(indx,0,crit)}/DQDDQ/RNCindx~{UP}~
13            /RNCindx~{DOWN}~{CALC}
14            {PUT indx,0,@ROWS(indx)-1,ptr}
15            {PUT indx,1,@ROWS(indx)-1,ss}
16            {PUT indx,2,@ROWS(indx)-1,name}{start}
17            {IF ptr}{SETPOS ptr}
18            {WRITELN ss}
19            {WRITELN name}
20            {WRITELN address}
21            {WRITELN city}
22            {WRITELN notes}
23            {GETPOS ptr}
24            {GOTO}block~
25            {CLOSE}
26
27   \r       {GETLABEL "Enter SS ",ss}
28            {LET ss2,ss}
29            /DQEQ
30            {OPEN filename,R}
31            {SETPOS loc}
32            {READLN ss}
33            {READLN name}
34            {READLN address}
35            {READLN city}
36            {READLN notes}
37            {CLOSE}
38            {GOTO}block~{GOTO}ss~
```

FIGURE 4

Note that range I1..I2 is named *crit*. This is the Criterion range that a macro will use to specify the Social Security number of the record you wish to enter or retrieve. Range I4..I5 is the Output range, named *output*, which will record the position of the database file pointer when that file is open. The two principal macros that drive the database appear in figure 4.

In the cell named *filename* (cell B7), the label *data.dbf* is the name of the database file that will correspond with this index. Each database that you create will have its own index. To make sure that the template you have created will be available for your own database, save the worksheet from the setup box. When you create your own database, retrieve the worksheet and change the file name in cell B7. Then immediately save that worksheet with a new name.

For example, to create a database named SALES, retrieve this worksheet and enter the label *sales.dbf* in cell B7. Then save the worksheet under the file name SALES. When you finish your work, save the worksheet once more. Any changes you have made in the database will already be on disk. But you must save the worksheet to preserve any changes in the index.

ENTERING DATA

Now let's test the model. Enter into range B1..B5 the record shown in row 2 of figure 1. Be sure that all entries are labels. Numbers or formulas will cause the macro to fail.

When you finish, hold down the MACRO key (Alt on most computers) and press E. The macro saves the record in a file named DATA.DBF and creates an entry in the worksheet's index. Enter the second record from figure 1 and run the macro again. Repeat the process for the third record. In each case, you will add a record to the disk database and add a row to the index.

Here's how the data-entry macro works:

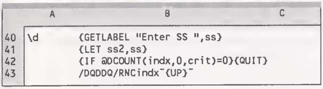
{LET ss2,ss} copies the label from the cell named *ss* (B1) to the cell named *ss2*. That cell is in the Criterion range you assigned to perform Data Query operations.

{IF @DCOUNT(indx,0,crit)}/DQDDQ/RNC indx~{UP}~ determines whether the Social Security number you entered already exists in the index. If it does, the macro uses the Data Query Delete command to delete the old record. Then it adjusts the bottom of the range named *indx* up one row. When you adapt this technique to your macro, you might include code that flashes a message such as *Replace old record? Y or N* to get the user's okay before deleting the old index record.

/RNCindx~{DOWN}~{CALC} extends the range of *indx* down one row to accommodate the new index entry and recalculate the worksheet.

{PUT indx,0,@ROWS(indx) − 1,ptr} copies the value from the cell named *ptr* to the first available cell in the *Location* column of the range named *indx*. The value in *ptr* identifies in bytes the location where the new record will begin in the database file.

{PUT indx,1,@ROWS(indx) − 1,ss} copies the label



```
        A                B                              C
40 \d        {GETLABEL "Enter SS ",ss}
41           {LET ss2,ss}
42           {IF @DCOUNT(indx,0,crit)=0}{QUIT}
43           /DQDDQ/RNCindx~{UP}~
```

FIGURE 5

from the cell named *ss* to the first available cell in the *SS* column of the range named *indx*.

{PUT indx,2,@ROWS(indx) − 1,name}{start} copies the label from the cell named *name* to the first available cell in the *Name* column of the *indx* range. The macro then calls the subroutine *start*, which appears as {RECALCCOL start}{OPEN filename,W} in cell B9 of figure 4.

Start contains a formula that produces one of two labels, depending on the value in the cell named *ptr*. The formula is:

> +"{RECALCCOL start}{OPEN filename,"
> &@IF(ptr,"M","W")&"}"

When the macro calls this formula as a subroutine, the formula immediately recalculates. If the cell named *ptr* contains a value of zero, the macro assumes that you haven't yet entered records in the database. The {OPEN} command then creates a file to receive the database. If *ptr* contains a nonzero value, the {OPEN} command looks for the file named in the *filename* range and opens it for modification. Refer to the "Keywords for Managing Files" box for more information on the file-handling commands used in this worksheet.

Here's what happens following the *start* subroutine:

{IF ptr}{SETPOS ptr} determines whether there is a value other than 0 in the cell named *ptr*. If there is, the macro assumes that the opened file contains database records, and the {SETPOS} command moves the file pointer to the end of the file. If *ptr* is 0, the macro doesn't process the {SETPOS} command because the file pointer is already at the end of the opened file.

{WRITELN ss} copies the label from the cell named *ss* to the disk file.

The subsequent WRITELN statements copy each of the field entries to disk in turn. As explained in the "Keywords for Managing Files" box, the {WRITELN} command records each entry on its own line in the file. The macro distinguishes each field within a record by the end-of-line character that the {WRITELN} command adds when it copies the field to disk.

{GETPOS ptr} stores in *ptr* a value that represents the new location of the file pointer. This value identifies the point at which the macro will store the next record you enter.

{GOTO}block~ moves the cell pointer to the upper-left cell in *block* (cell A1).

{CLOSE} closes the database file.

RETRIEVING A RECORD

Once you've stored information in a disk-based database, use the macro named \r to retrieve it. Press MACRO-R and, at the prompt, enter the Social Security number for the record you want to see. The record appears in the data-entry area, replacing whatever record was previously displayed there.

If you don't know the Social Security number of the record you want, you can examine the index to find it. Press the GOTO key, followed by the NAME key. Indicate *indx* as the target range. Scroll through the index until you find the name of the individual. Then press MACRO-R and enter the corresponding Social Security number. Note that you do not need to enter a label prefix here because the macro interprets any entry as a label.

For a very large index, you may wish instead to expand the Criterion range by one column to the right—that is, to encompass range J1..J2—so that you can include *Name*. Then you can use the Data Query Find command

HOW TO SET UP THE WORKSHEET

1. Individual column widths

Column	Width
A	18
B	31
F	15

For example, to set the width of column A, place the cell pointer in column A, select /Worksheet Column Set-Width, and enter 18.

2. Labels

Enter all labels printed in black in figures 2, 3, 4, and 5.

3. Range names

Name	Range
address	B3
city	B4
filename	B7
name	B2
notes	B5
ptr	B8
ss	B1
start	B9
\d	B40
\e	B11
\r	B27
block	A1..B6
indx	E1..G2
ss2	I2
loc	I5
crit	I1..I2
output	I4..I5

To assign the range names in the first group (*address* through *\r*), select /Range Name Labels Right, and specify range A1..A40. To assign the range names of the second group, select /Range Name Create, enter the name, then indicate the range.

4. Enter formulas

Cell	Formula
B9	+"{RECALCCOL start}{OPEN filename," &@IF(ptr,"M","W")&"}"

5. Miscellaneous

To prepare for macro-driven database operations, select /Data Query Input and enter *indx*, select Criterion and enter *crit*, and select Output and indicate range I4..I5. Select Quit to return to Ready mode. Then save the worksheet.

to locate the index entry containing the individual's name.

Here's how MACRO-R works:

{GETLABEL "Enter SS ",ss} prompts you to enter a Social Security number and stores your entry as a label in the cell named *ss*.

{LET ss2,ss} copies the label from the cell named *ss* to *ss2*. This label will serve as a criterion for the Data Query Extract command.

/DQEQ issues a Data Query Extract command that copies the location of the record that contains the Social Security number you entered from the index into the cell named *loc* (cell I5). The macro then selects Quit to exit from the Data Query menu.

{OPEN filename,R} opens, for reading only, the file whose name appears in *filename*.

{SETPOS loc} sets the file pointer to the position identified by the value in *loc*. *Loc* is the leftmost cell of the Output range into which the macro just copied the index record you requested. The file pointer moves to the first character of the corresponding database record on the disk.

{READLN ss} copies one line from the file to the cell named *ss*.

Each subsequent {READLN} statement copies an entry from the database record into its corresponding cell in the worksheet.

{CLOSE} closes the disk file.

{GOTO}block~{GOTO}ss~ moves the cell pointer to the top-left corner of *block* (cell A1), then to the cell named *ss*. This lets you view the record that the macro just retrieved from the disk.

KEYWORDS FOR MANAGING FILES

A file is a collection of information stored on your computer's floppy disk or hard disk. *1-2-3* has a number of macro commands that let you work with ASCII, or text, files of your own design. With these commands, your macros can create, write, and read files. These procedures are usually called file input/output or file I/O. Review your *1-2-3* documentation for a discussion of the advanced macro keywords that perform file I/O operations.

For a macro to perform file I/O operations, it must first use the {OPEN} command, with the syntax {OPEN *filename*, *access-mode*}, to gain access to a specific disk file. A macro can open a file to read information from the file, to write information to the file, or to modify the file's contents. You must specify in the {OPEN} command—with R, W, or M—which of these operations the macro is to perform. A macro uses the {CLOSE} command to end its I/O operations.

To write to an opened file, you can use one of two commands. The {WRITE} command, with the syntax {WRITE *string*}, copies to the file only the characters in the string. The {WRITELN} command, with the syntax {WRITELN *string*}, copies to the file the characters in the string and then adds an end-of-line marker, which adds 2 bytes to the space occupied by the string.

The {READ} and {READLN} commands mirror the operations of {WRITE} and {WRITELN} by bringing data from the opened file into the worksheet. The {READ} command, with the syntax {READ *bytecount*,*location*}, reads the number of characters indicated by *bytecount*. The {READLN} command, with the syntax {READLN *location*}, reads every character in sequence until it encounters an end-of-line marker. In both commands, *location* denotes the worksheet cell that will receive the string as a left-aligned label.

The model in the accompanying article uses the {READLN} and {WRITELN} commands for all of its file I/O. By writing each field with {WRITELN}, the data-entry macro delimits the fields with end-of-line markers. By reading each record with {READLN}, the **\r** macro delineates each field as a string between two end-of-line markers.

Two other key commands in I/O operations are those that determine the position of a record in the database file.

The {GETPOS} command, with the syntax {GETPOS *location*}, determines the current location of the file pointer in the open file and records it in the worksheet cell indicated by *location*. In the data-entry macro in the accompanying article, that location is cell B8, named *ptr*.

Location is simply the number of bytes from the beginning of the file. A file's first byte is numbered 0. Each end-of-line marker counts as two bytes.

The {SETPOS} command, with the syntax {SETPOS *file-position*}, sets a new position for the file pointer in the open file. The command {SETPOS 2}, for example, moves the file pointer to the third character in the open file.

The data-entry macro in the article uses the {GET POS} and {SETPOS} commands to maintain the database index.

After you save a new record to disk, the file pointer resides at the end of the file. The macro uses {GET POS} to record that location so that it will know where to store the next record.

When you specify a record to retrieve, the macro uses {SETPOS} to move the pointer to the record's first character. The subsequent {READLN} commands move the pointer from one end-of-line marker to the next as they bring the fields of the requested record into the worksheet.

CHANGING AND DELETING

It's easy to change a database record. Use macro \r to retrieve the record and edit the data. Then save the modified record to disk—and update the index—by pressing MACRO-E.

Deleting a record calls for another macro, which is shown in figure 5 on page 29.

To use the macro, press MACRO-D and enter the Social Security number of the record. The macro finds and erases that index entry. It then redefines the *indx* range to be one line less in depth.

To see how the macro stores records in the disk file, enter *type data.dbf* at the DOS prompt. You will find the file named DATA.DBF in the directory that was current when you ran the macro. Use the File Directory command to determine the current directory.

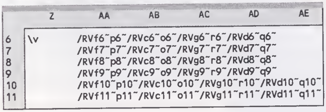
Be aware that when you use this model to change or delete a record, the original record remains in the disk database. When you edit a record, you change the index entry, but instead of altering the existing record, you create a new record that is added to the end of the existing disk database. When you delete a record, you delete the index entry, but the record itself remains untouched. Because the index has been changed, it will not locate those original records. But there is a potential problem: Your disk may fill up with obsolete records.

Our data-entry macro does not address that problem. If you wish to attack it yourself, consider this: To reclaim wasted disk space, the macro must keep track of the space occupied by records that have been superseded or, supposedly, deleted. The task of selecting an appropriate space is easier if the macro also pads out every record so that each occupies the same amount of space. The macro can then put a new record into an old slot without danger of overwriting part of a live record.

MACRO LETTERS

COPYING A MACRO

I've written a useful "year-to-date" macro. Unfortunately, the macro's addresses don't adjust when I copy the macro from line to line:



```
         Z        AA        AB        AC        AD        AE

6    \v       /RVf6~p6~/RVc6~o6~/RVg6~r6~/RVd6~q6~
7             /RVf7~p7~/RVc7~o7~/RVg7~r7~/RVd7~q7~
8             /RVf8~p8~/RVc8~o8~/RVg8~r8~/RVd8~q8~
9             /RVf9~p9~/RVc9~o9~/RVg9~r9~/RVd9~q9~
10            /RVf10~p10~/RVc10~o10~/RVg10~r10~/RVd10~q10~
11            /RVf11~p11~/RVc11~o11~/RVg11~r11~/RVd11~q11~
```

I can copy the original line down and edit the cell addresses in the copied commands. But how can I make the cell addresses adjust automatically when I copy the macro to a new line?

Robert Shultz
The Trane Co.
Phoenix, Ariz.

The editor replies: It's not clear what you want your macro to accomplish. Do you wish to perform the series of Range Value commands once per row and never again, or do you wish to perform these commands for every row each time you run the macro?

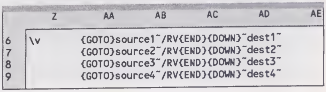
Assuming you've assigned the macro name to the first cell that contains commands (AA6 in this case), *1-2-3* processes each Range Value command in every cell to the last contiguous cell in column R (note that Release 1A doesn't have a Range Value command). This must take a long time as your spreadsheet expands into hundreds of rows.

The Range Value command can copy the values of an entire column of formulas. There's no need to proceed row by row. Rather, erase your macro and start from scratch.

Assign range names as shown in the following table. To assign a range name, select /Range Name Create, enter the name, then enter the name's corresponding address:

Name	**Cell**
source1	**F6**
dest1	**P6**
source2	**C6**
dest2	**O6**
source3	**G6**
dest3	**R6**
source4	**D6**
dest4	**Q6**

Enter the following macro in place of your original, and assign the macro's name by selecting /Range Name Labels Right and indicating cell Z6:



```
         Z        AA        AB        AC        AD        AE

6    \v       {GOTO}source1~/RV{END}{DOWN}~dest1~
7             {GOTO}source2~/RV{END}{DOWN}~dest2~
8             {GOTO}source3~/RV{END}{DOWN}~dest3~
9             {GOTO}source4~/RV{END}{DOWN}~dest4~
```

The macro is ready to run. Whenever you wish to update the values in columns O, P, Q, and R, hold down the MACRO key and press V. Here's what the macro does:

`{GOTO}source1~/RV{END}{DOWN}~dest1~` presses the GOTO key and enters *source1* as the destination cell; the cell pointer jumps to cell F6. Then this macro step selects /Range Value, indicates all entries in column F as the From range, and indicates *dest1* (cell P6) as the To range. This copies to column P the values of all the formulas in column F.

`{GOTO}source2~/RV{END}{DOWN}~dest2~` copies the values from column C to column O.

`{GOTO}source3~/RV{END}{DOWN}~dest3~` copies the values from column G to column R.

`{GOTO}source4~/RV{END}{DOWN}~dest4~` copies the values from column D to column Q.

This macro design assumes that there are no blank cells in columns F, C, G, and D. The macro will, however, copy every contiguous formula in each of those columns, no matter how many rows of data you have. ■

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WHAT'S A MACRO?

A macro is a series of instructions that *1-2-3* and *Symphony* carry out automatically. You create a macro by entering labels in a column of the worksheet. These labels contain instructions that represent any of the letters, numbers, special characters, or function keys that you'd normally type at the keyboard.

It's easiest to understand what a macro is by seeing a few in action. But before we create any macros, let's create a worksheet in which to use them. To follow this discussion, start in a blank worksheet and create the project-tracking database shown in the illustration at the top of the next page.

Set column widths as follows: A–10, B–5, D–8, E–8, F–8. For example, to set the width of column A, move the cell pointer to column A, press slash, select Worksheet Column Set-Width, and enter 10 (in *Symphony* select MENU Width Set, and enter 10.) Enter labels and numbers as shown, taking care to enter the percentages in column B as decimal values. For example, enter 88% either as .88 or

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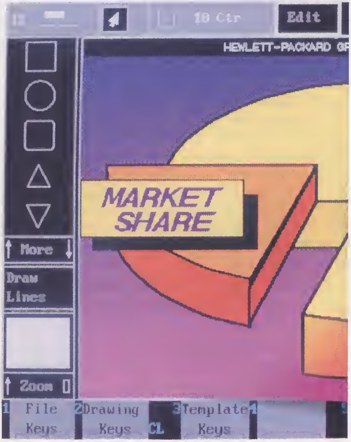
that's easy a:



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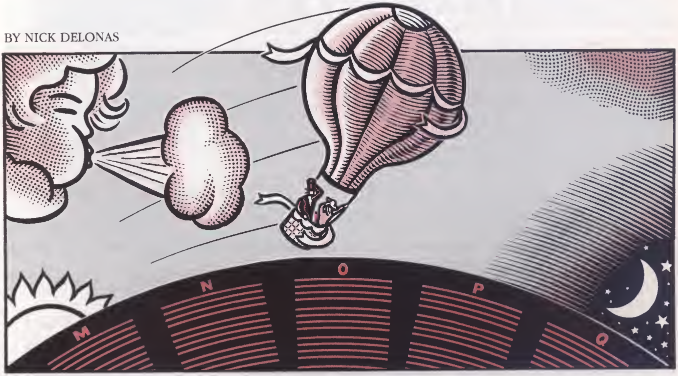
MACRO BASICS

AROUND THE WORKSHEET IN 80 CENTISECONDS

If you've never written a macro, begin by building these to help you breeze around your spreadsheet.

BY NICK DELONAS



Moving the cell pointer manually is usually the best and fastest way to get around your spreadsheet. There may be times, however, when you repeatedly have to move the pointer a preset number of cells. For example, you may need to change information in the third, seventh, and twelfth columns of each row of a database. In such a case, you'd enter data, press the RightArrow key four times, enter data, press the RightArrow key five times, enter data, press the DownArrow key, press the LeftArrow key nine times, and restart the procedure on the next row.

If you perform the task as described, you issue about 20 more keystrokes per row than you would if you used a macro. A macro can reduce the number of keys you press to perform most tasks. Although writing macros is often considered a job only advanced spreadsheet users can handle, a macro is often as easy to write as it is to describe the task you wish to accomplish. If you've never written a macro and you use *1-2-3* Release 2/2.01 or any release of *Symphony*, follow along.

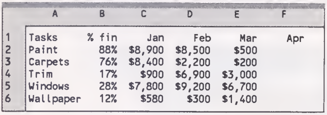
WHAT'S A MACRO?

A macro is a series of instructions that *1-2-3* and *Symphony* carry out automatically. You create a macro by entering labels in a column of the worksheet. These labels contain instructions that represent any of the letters, numbers, special characters, or function keys that you'd normally type at the keyboard.

It's easiest to understand what a macro is by seeing a few in action. But before we create any macros, let's create a worksheet in which to use them. To follow this discussion, start in a blank worksheet and create the project-tracking database shown in the illustration at the top of the next page.

Set column widths as follows: A–10, B–5, D–8, E–8, F–8. For example, to set the width of column A, move the cell pointer to column A, press slash, select Worksheet Column Set-Width, and enter 10 (in *Symphony* select MENU Width Set, and enter 10.) Enter labels and numbers as shown, taking care to enter the percentages in column B as decimal values. For example, enter 88% either as .88 or

TIM GRAJEK



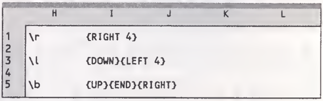
	A	B	C	D	E	F
1	Tasks	% fin	Jan	Feb	Mar	Apr
2	Paint	88%	$8,900	$8,500	$500	
3	Carpets	76%	$8,400	$2,200	$200	
4	Trim	17%	$900	$6,900	$3,000	
5	Windows	28%	$7,800	$9,200	$6,700	
6	Wallpaper	12%	$580	$300	$1,400	

as 88%. To format range C2..F6, select /Range Format Currency (in *Symphony*, MENU Format Currency), enter 0, and indicate range C2..F6. Then select /Range Format Percent (in *Symphony*, MENU Format %), enter 0, and indicate range B2..B6. Right-align the labels in range C1..F1: Select /Range Label Right (in *Symphony*, MENU Range Label-Alignment Right) and indicate range C1..F1.

We've shown a small part of a database that tracks the monthly expenses of several tasks that are part of a large project. Column B of the database lists by what percentage each task is complete. Every month you add a new column of dollar figures and replace the percentages with new values representing the total progress to date.

When you update the database each month, you repeatedly move the cell pointer between the *% fin* column and the column representing the current month. To help with the task, create the macros shown in the following figure.

Enter the labels as shown, and remember to start each of the labels in column H with an apostrophe label prefix.



	H	I	J	K	L
1	\r	{RIGHT 4}			
2					
3	\l	{DOWN}{LEFT 4}			
4					
5	\b	{UP}{END}{RIGHT}			

Then assign the labels in column H as range names for the adjacent cells in column I. To do this, press slash (in *Symphony*, MENU), select Range Name Labels Right, and indicate range H1..H5. You've just created three macros.

MACROS IN ACTION

Move the cell pointer to cell B2 and enter 91%. Then hold down the MACRO key (Alt on most computers) and press R. The cell pointer jumps four cells to the right so that you can enter a dollar amount in the April column.

When you hold down the MACRO key and press a letter, *1-2-3* and *Symphony* determine whether there is a range name that consists of a backslash followed by the letter you pressed. If one exists, the macro processor follows all instructions contained in the named cell—as if you were pressing the keys.

The macro named *\r*, which resides in cell I1, consists of a {RIGHT} command, which means "press the Right-Arrow key." When you include a numeric argument within the command's braces, the macro processor presses

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MACRO BASICS *continued from page 36*

the RightArrow key as many times as indicated by the argument. Hence, the command {RIGHT 4} causes the macro processor to press the RightArrow key four times whenever you run the macro named \r.

The cell pointer should now be in cell F2. Type 500 and press Return, then hold down the MACRO key and press L. The cell pointer moves down one cell and then to the left four columns. You're ready to change the completion percentage for the next task in the list.

The macro named \l resides in cell I3. It uses the {DOWN} command and the {LEFT} command to press the DownArrow and LeftArrow keys, respectively. And just as the first macro uses a repeat count of 4 in its {RIGHT} command, this macro uses a repeat count in the {LEFT} command.

Suppose the cell pointer is poised in cell B3 to accept your next entry and you realize that you made an error in entering the previous dollar amount. Get back to your last entry quickly by pressing MACRO-B.

The macro named *\b* in cell I5 presses the UpArrow key, the End key, and the RightArrow key, in turn. Pressing the End key prior to pressing the RightArrow key causes the pointer to move to the last cell in any series of contiguous cell entries or to the first nonblank cell after a series of contiguous blank cells. In our example, the macro moves the cell pointer to cell F2, where you entered $500. Change the $500 to $400, then press MACRO-L to move the cell pointer back to cell B3.

YOUR OWN WORKSHEETS

Our examples reveal that writing a macro is as easy as deciding which keys you want the macro processor to press. While we've demonstrated only five of the macro commands that move the cell pointer around the worksheet, all of the cursor-movement keys have macro-command equivalents. You should have no trouble matching the following macro commands with the cursor-movement keys they represent: {DOWN}, {RIGHT}, {LEFT}, {UP}, {END}, {PGUP}, {PGDN}, {HOME}.

Experiment with these commands and create macros to help with your data-entry tasks. Don't be afraid to create a few useless macros for the sake of experimentation. In the course of preparing this article, we strung together the commands {END}{RIGHT}{END}{DOWN}{END}{LEFT}{END}{UP}. On our 80286-based computer, these commands move the cell pointer around the perimeter of the worksheet, 16,896 cells, in about 80 centiseconds. It's not the most practical macro in the world, but it provided a catchy title for the article. ■

Send Us Your Macros

If you have questions about macros, send them to us. If you have a favorite macro technique, we'd like to see it. If we use your letter in a column, we'll send you $25. Write to: Macros Editor, LOTUS *Magazine, P.O. Box 9123, Cambridge, MA 02139–9123.*

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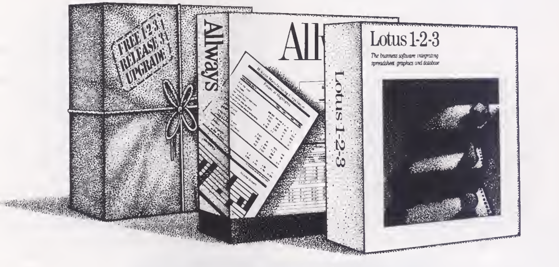
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CIRCLE 123 ON READER SERVICE CARD

FOR DEVELOPERS

MACRO-DRIVEN TEMPLATES

You and your template users will be happiest if your macros never release control of the worksheet.

BY JEFFREY J. BIANCHINE

Let's face it, not every template user possesses a high level of spreadsheet competence. The trouble is, if someone fouls up with one of your templates, you're likely to take the blame.

When you overestimate the technical ability of your users, you may end up having to provide them with extra training or, worse, having to repair the files they damage. To prevent such extra demands, design templates that limit the types of mistakes users can make. Specifically, design models that are fully macro-controlled.

ADVANTAGES OF COMPLETE MACRO CONTROL

Macro-controlled templates have benefits for both users and developers. Users benefit from reduced training, increased productivity, and greater integrity of their data. Developers benefit from having their macros well protected from users and from needing less time for user training and support.

Training A macro-driven system makes the nuts and bolts of *1-2-3* or *Symphony* transparent to the user. This transparency lets even a neophyte tap the power of the software. Users need only to learn how to select a command from a menu and how to enter data. Well-designed macro routines do everything else.

The menus in a macro-driven model identify specific tasks a user might wish to accomplish. Once the user makes a selection from the template's menu, the macro accesses the menus and functions of the software. Thus macros shield users from the underlying program's complexity.

Productivity A macro-driven template automates such time-consuming tasks as recording and manipulating data, generating reports, and backing up files. Generally, a macro prompts for data entry as necessary, and the user interacts with a limited data-entry area of the worksheet. Macros move data to and from appropriate data-storage areas and display only the information the user needs at any particular moment. All reports are predefined and printable with menu selections. Macros save files at specific intervals and when the user exits from the template.

Data integrity Prevention of data-entry errors is a key facet of any macro-driven template. The macro checks all data as it is entered and can require that users enter only labels when labels are called for or only numbers when the application requires numbers. A macro can also verify that the values a user enters fall within logically feasible ranges and that each entry makes sense, given the data already entered. For example, a sales-commission template might require that a sales representative's bonus be entered as less than 20% of the representative's gross sales.

Entering data that doesn't meet the preprogrammed criteria causes a macro-driven template either to sound a warning or to reject the entry. A macro-driven template should also let its users correct the simple errors that occasionally slip through. For example, the user should be able to correct spelling errors without reentering all

---

Jeffrey J. Bianchine is a free-lance writer, microcomputer consultant, and educator living in Syracuse, N.Y.

TIM GRAJEK

Manage Your Projects in 1-2-3

Projects arise every day in your company or department. You plan for them, but plans and schedules change all too frequently. If only you could keep track of schedules as easily as you manage your budget on a spreadsheet! Now there's a way -- with Project Calc, an "add-in" for 1-2-3 or Symphony, from Frontline Systems.

> *"Many managers do not have time to learn stand-alone project management packages ... Project Calc offers numerous project management functions within the familiar, easier-to-learn 1-2-3 environment."*

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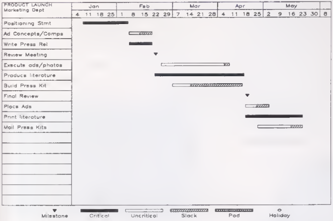
> *"Even those with minimal project management experience should be able to design a simple project in less than one hour."*

Project Calc may be easy and inexpensive, but it's no lightweight. You can create any number of projects on a single spreadsheet. The number of tasks and time periods is limited only by your available memory (including EMS).

SAMPLE GANTT CHART FROM PROJECT CALC
Printed on HP LaserJet II with Lotus PrintGraph



Schedules can vary from hours to years in duration. Tasks can follow or overlap any number of other tasks. And you can specify straight time, a worktime calendar including weekends and holidays you specify, or work effort such as manhours. You can even vary the number of work hours on each day.

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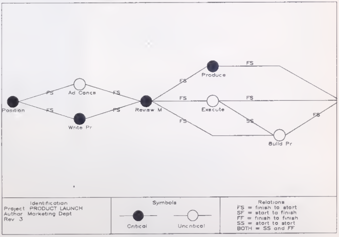

> *All quotes in boxes are from Review Board, InfoWorld, September 5, 1988, pages 71-72.*

Project Calc works with 1-2-3 Release 2 or with Symphony 1.1, 1.2, 2.0. It requires 140K (subset can be used in 40K) and CGA, EGA, VGA or Hercules graphics card. Why not try Project Calc today for $179.95 under our 30-day money-back guarantee, and see for yourself how you can manage projects on your spreadsheet!

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Support policies	(40)	Very Good
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Final score		**7.0**

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CIRCLE 114 ON READER SERVICE CARD

the information of a particular data record.

Macro protection A well-designed model means a higher margin of protection for your work. If the macro remains in control through an entire work session, the macro code itself remains out of reach of the casual user. This prevents accidental damage and may thwart intentional alteration by less-than-expert saboteurs.

Less support Responsible developers include on-line help in their templates. The more help the template offers the user, the less time the developer spends on the telephone reexplaining concepts or commands.

TYPICAL COMPONENTS OF A MACRO-DRIVEN TEMPLATE

To reap the benefits of a macro-driven template, a developer must incorporate several features into a model. Check the following list:

Menus The heart of the macro-driven template is the macro menu. The macro should automatically display a menu of choices when a user retrieves the file. The user shouldn't need to know what the MACRO key is or how to use it.

In a well-designed template, each menu option has a clear description, and submenus progress in a logical order. The user is able to backtrack through the menus as well as move forward. Pressing the Escape key should call up each submenu's parent menu, just as pressing Escape in *1-2-3* or *Symphony* returns you to the previous menu in a sequence. Also, each macro menu should include a Quit option that has the same effect as pressing Escape.

Reports The template should be able to print all reports on request, and users should be able to customize them by making selections from the macro's menus. Such selections might include the ability to change pitch, font, print quality, printer, and so on.

Help One way to provide on-line help is to include Help as either the first or last choice on each menu. The positioning of the Help option should be consistent across all menus in the template. Selecting Help should bring up a screen of context-sensitive instructions—that is, instructions relevant to the task at hand. You can store these instructions in the worksheet or import them into a reserved area of the worksheet as required.

Files A macro-driven template should perform all file-handling tasks, such as saving and opening files, exporting and importing ranges, and even backing up files.

PROBLEMS WITH A MACRO-DRIVEN SYSTEM

Clearly, macro-driven templates offer tremendous benefits to both users and developers. However, there are a few costs associated with those benefits.

Performance Unfortunately, a macro-driven template might be a little sluggish. The macros in a template can greatly inflate the size of a worksheet. Consequently, recalculating the worksheet and retrieving, saving, and backing up files takes longer than in a macro-free template. Also, a large macro-driven worksheet might require so much RAM that users won't be able to run their favorite background programs. Such a worksheet also consumes more disk space than a less complex model.

Planning Planning a macro-driven model is more involved than planning an ordinary template. Not only must you lay out the worksheet's formulas and labels, but you must design menu structures, help screens, and prompts. You need to consider what users will see on the screen and how they will interact with the model. You must know in advance what reports the model will produce so that you allow room in the worksheet for any structures that support report printing. If your model will consist of more than one file, you might need to design file structures. Most important, you need to anticipate every error that could occur while someone is using your template.

Although it may be a bother in planning a template, talking to the people who will use it is an important process in the creation of the model. There's no sense in building a model that doesn't satisfy its user's needs.

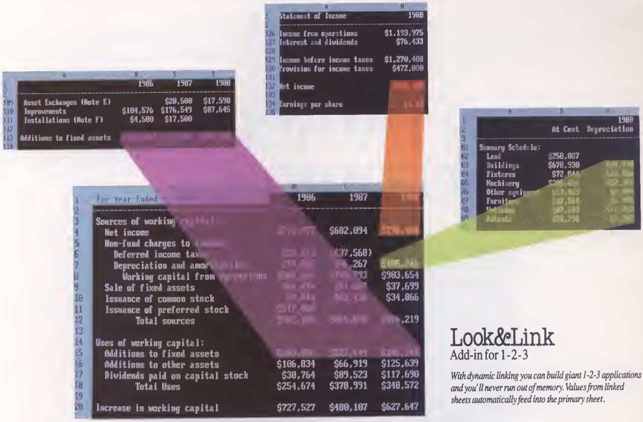
You can also minimize the drawbacks associated with macro-driven templates by including the user in the planning process. Show users screen layouts and sample reports before you jump into detailed programming. Develop prototypes that show the system of screen displays with representative menus and sample report layouts. Users can request layout modifications while it's still easy for you to make changes. By eliminating problems early in the development process, you will reduce your involvement with a template once it's in your users' hands.

Programming You might design and build some templates very rapidly, but for most wholly macro-controlled templates, the programming will be more complex. Generally, you build a template's macros one module at a time. You might create the data structures first, then the data-entry routines, then the report-generation macros, and finally the help facility.

Test-running, redesigning, and debugging each module as you create it is a natural part of any development process. However, the true testing comes when you've finished building the model. You should push every function of the template to its limit before you assume you've caught all the bugs. Depending on the complexity of the model, it can take days, weeks, or even months to finish programming and debugging.

Maintenance Once the template or system of templates is finished and people are using it, your work is not necessarily done. Quite often, a customer contracts for service beyond the scope of the programming, installation, and training. And when you create templates for use within your own company, you can count on people banging on your door for attention.

Of course, any responsible developer should provide a solution if a user discovers a bug in the template. If you are the only person who can access a template's macros, there is an implied obligation to provide some type of service. The more complicated the template, the greater the hassles of troubleshooting. ■



```
                            1986      1987      1988
------------------------------------------------------
Asset Exchanges (Note E)            $20,500   $17,590
Improvements             $104,576  $176,549   $87,645
Installations (Note F)     $4,500   $17,500

Additions to fixed assets
```

```
Statement of Income                       1988
----------------------------------------------
Income from operations              $1,193,975
Interest and dividends                 $76,433

Income before income taxes          $1,270,400
Provision for income taxes            $472,000

Net income

Earnings per share
```

```
                                1988
                     At Cost  Depreciation
-------------------------------------------
Summary Schedule:
  Land               $258,007
  Buildings          $678,930
  Fixtures            $72,84
  Machinery
  Other equi
  Furnitu
```

```
For Year Ended                 1986       1987
----------------------------------------------------
Sources of working
  Net income                          $682,094
  Non-fund charges to
    Deferred income tax              ($37,560)
    Depreciation and amo                  ,267
      Working capital from                       $903,654
  Sale of fixed assets                            $37,699
  Issuance of common stock                        $34,066
  Issuance of preferred stock
        Total sources                               ,219

Uses of working capital:
  Additions to fixed assets
  Additions to other assets    $106,834   $66,919  $125,639
  Dividends paid on capital stock $30,764 $89,523  $117,690
        Totai Uses             $254,674  $378,991  $340,572

Increase in working capital    $727,527  $480,107  $627,647
```

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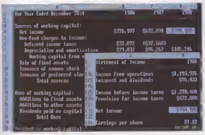

You can scroll up, down, left or right, move and resize the window, swap sheets between windows, and cut and paste between sheets. And that's just the beginning.

Build multi-sheet applications.

With LOOK & LINK, any worksheet can pull information out of other worksheets on disk or expanded memory (optional). You might link a 1040 tax worksheet to its supporting schedules.

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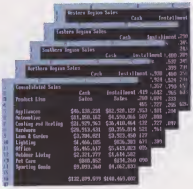
LOOK & LINK also does automatic consolidations, complete with audit trail. You might sum twelve monthly P&Ls to create an annual report or sum regional sales worksheets to produce a national consolidation.



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CIRCLE 115 ON READER SERVICE CARD

WHEN TWO (OR MORE) BECOME ONE

Do you ever need to pull one cell or a range of cells from one file into another? Perhaps you want to copy a row of monthly totals from a travel-and-entertainment budget worksheet into a row on the summary budget worksheet. Or maybe your branch office submitted a sales forecast and you need to add its projected sales to yours. Manually rekeying data is not the answer. You need the File Combine commands.

With these commands, you can swiftly replace data in one file with data in another file or append data in one file to data in another file. You can also add and subtract values from one file to another. While the commands do not "link" your worksheets—that is, do not automatically update a file if you change the same figure in another file—they are handy for moving data into existing files.

This article explains the basics of combining files. Once you've mastered that, you'll learn some specific applications for these handy commands.

To begin, let's review the commands themselves.

BY PHYLLIS A. SHARON

The File Combine commands unite data stored in separate files.

Throughout the article, the file you combine data into is called the target file. The file containing the data to be combined is called the source file.

Copy The Copy option replaces data in the target file with data from the source file. Entries brought in from a source file retain their formats and, in the case of labels, their alignment. The cell references of formulas from the source file adjust to reflect their new positions in the target file. Blank cells from the source file do not overwrite existing cell entries in the target file.

Add and Subtract The Add option allows you to add values to a target file, while the Subtract option allows you to subtract values from a target file. Using these options, you can consolidate information from two or more files into a single file. Since these menu choices do not bring in labels from the source file to the target file, all labels in the target file remain the same. If an incoming value overlays a target-file cell containing a formula, the incoming value is ignored and the formula remains unchanged.

MODELS JOYCE CULKIN, PHOTOGRAPHY DANA SIGALL

Entire File or Named/Specified-Range (Named Range in *1-2-3* Release 1A, Named-Area in *Symphony*) These options allow you to indicate how much of the source file to combine into the target file. Entire-File instructs *1-2-3* and *Symphony* to combine all cells from the source file into the target file.

Selecting Named/Specified-Range instructs *1-2-3* and *Symphony* to combine only the cells in a specific range of the source file into the target file. After you choose this option, *1-2-3* prompts you for the range's name or coordinates. *Symphony* prompts you for the range or a line-marker name.

If you select Named/Specified-Range, you must enter the correct name of the range you want to combine. *1-2-3* and *Symphony* don't provide a list of the named ranges in the source file. If the file you specify doesn't contain the range name you indicate, *1-2-3* and *Symphony* will display the message *Named range not found in worksheet file*. Avoid this dead end by recording the name of the range you plan to combine before beginning the process. (In *1-2-3* Release 1A you can specify only the range name, not the cell coordinates.)

Symphony users have two additional menu selections.

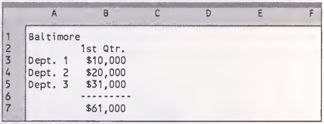
Ignore or Read Selecting Ignore instructs *Symphony* to combine the file or named range without bringing in the range or line-marker names. Selecting Read combines the range and line-marker names from the source file into the target file.

There are a couple of warnings about using the Read selection in conjunction with the Named-Area option. First, *Symphony* combines *all* range names from the source file into the target file, and range names in the source file overwrite matching range names in the target file. Second, the source file's ranges may "wrap around" the worksheet. For example, suppose a worksheet contains two named ranges: *first* in range A1..A3 and *second* in range C1..C3. If you position the cell pointer in cell A1 of a target worksheet and combine the named area *second*, the range named *second* appears in range A1..A3, while the range named *first* "wraps around" the worksheet and appears in range IV1..IV3. You'll want to keep these warnings in mind when combining files containing range names.

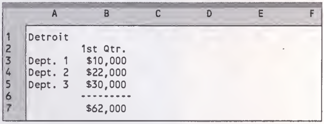
Formulas or Values This option applies only when you use File Combine Copy, since *Symphony* always uses values when you select Add or Subtract. Using these selections, you specify whether you want to combine formulas or only the current values of formulas from the source file into the target file. If you don't need the formulas in the target worksheet, you'll cut down on memory use and recalculation time by combining only values into the target file.

THREE SIMPLE EXAMPLES

Now let's use the File Combine commands. Suppose you manage two branch offices, one located in Baltimore and the other located in Detroit, and you receive quarterly sales reports from each. The first quarter's reports appear below. The Baltimore file is named B_Q1, while the Detroit file is named D_Q1. Both files are structured identically—for example, the sales figure for each department and the total sales figure are in the same cells in both files. This identical structure ensures successful file combinations.



```
      A         B         C         D         E         F
1  Baltimore
2          1st Qtr.
3  Dept. 1   $10,000
4  Dept. 2   $20,000
5  Dept. 3   $31,000
6          ---------
7            $61,000
```



```
      A         B         C         D         E         F
1  Detroit
2          1st Qtr.
3  Dept. 1   $10,000
4  Dept. 2   $22,000
5  Dept. 3   $30,000
6          ---------
7            $62,000
```

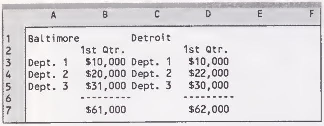
Let's say you want to look at the quarterly sales of both offices simultaneously. To do that, you have to append data from one file to another file, and that calls for the File Combine Copy command.

To create the upper figure, format range B3..B7 for currency with no decimal places. In *1-2-3* select /Range Format Currency, enter 0, and specify range B3..B7. (In *Symphony* select MENU Format Currency, enter 0, and specify range B3..B7.) Enter the labels in column A and cell B2. To create the dashed line in cell B6, enter a backslash and a hyphen (\−). Enter the values in range B3..B5. Enter the formula @SUM(B3..B5) in cell B7. Select /File Save (in *Symphony*, SERVICES File Save) and enter the name B_Q1. To create the lower figure, begin in the file named B_Q1. Change the label in cell A1 to read *Detroit*. Change the values in range B4..B5 to those shown in the lower figure. Select /File Save (in *Symphony*, SERVICES File Save) and enter the name D_Q1.

To begin, retrieve B_Q1, which becomes the target file. This is the file into which you will combine D_Q1, the source file. Position the pointer in cell C1, the upper-left corner of the range in which the Detroit data will appear. Select /File Combine Copy Entire-File (in *Symphony*, SERVICES File Combine Copy Entire-File Ignore Formulas) and specify file D_Q1.

The Detroit report now appears in columns C and D, as shown in the figure at the top of the next page. In this example, no data resided in columns C and D of the target file. If data had been present, data from the source file would have overwritten it.

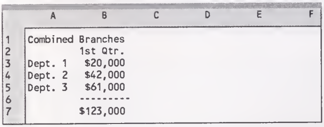
The File Combine Copy command copies labels, values, and formulas from the source file to the target file. In



```
     A         B         C         D         E         F
1  Baltimore           Detroit
2           1st Qtr.            1st Qtr.
3  Dept. 1   $10,000 Dept. 1   $10,000
4  Dept. 2   $20,000 Dept. 2   $22,000
5  Dept. 3   $31,000 Dept. 3   $30,000
6          ---------           ---------
7            $61,000            $62,000
```

addition, both relative and absolute cell references shift to reflect their new location. For example, the formula @SUM(B3..B5) from file D_Q1 reads @SUM(D3..D5) in the above combined file.

Now suppose you want to create a sales report like the one shown below, which displays the total sales for both branches. You have to add together values from two files, and that calls for the File Combine Add command.



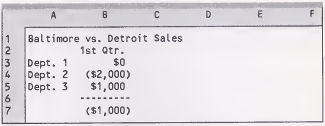
```
     A         B         C         D         E         F
1  Combined Branches
2           1st Qtr.
3  Dept. 1   $20,000
4  Dept. 2   $42,000
5  Dept. 3   $61,000
6          ---------
7           $123,000
```

Retrieve file B_Q1 and position the pointer in cell A1. Select /File Combine Add Entire-File (in *Symphony*, SERVICES File Combine Add Entire-File Ignore Formulas) and specify file D_Q1. The values in the Detroit sales file are automatically added to those located in the Baltimore file. The labels in the Baltimore file remain unchanged, as does the formula in cell B7. Finally, change the label in cell A1 to *Combined Branches*, and your sales report is complete.

As you see, by using the File Combine Add command, you avoid having additional columns of values and formulas in the file. The combined branch report contains only three values and one formula. The alternative approach requires a column for the Detroit sales figures and additional formulas to calculate departmental, branch, and grand totals. So if you don't need to see the specific values that you're adding, use File Combine Add. You'll save memory and recalculation time.

Finally, suppose you want to compare department sales totals in the Baltimore branch with those in the Detroit branch. The File Combine Subtract command lets you find out which departments of which branch made more money in the first quarter.

To begin, retrieve the file B_Q1. Position the pointer in cell A1. Select /File Combine Subtract Entire-File (in *Symphony*, SERVICES File Combine Subtract Entire-File Ignore Formulas) and specify file D_Q1. This command instructs the program to subtract Detroit sales from Baltimore sales. The results appear at the top of the next column. All you need to do is change the label in cell A1 to *Baltimore vs. Detroit Sales.*



```
     A         B         C         D         E         F
1  Baltimore vs. Detroit Sales
2           1st Qtr.
3  Dept. 1        $0
4  Dept. 2   ($2,000)
5  Dept. 3    $1,000
6          ---------
7           ($1,000)
```

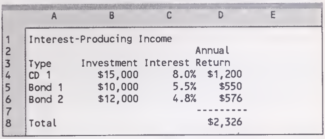
As this figure shows, in the first quarter, Department 1 of both branches generated the same amount of sales. Department 2 of the Baltimore office generated $2,000 less in sales than did Department 2 of the Detroit office, while Baltimore's Department 3 generated $1,000 more in sales than Detroit's Department 3. In all, sales in the Baltimore office were only $1,000 lower than the first-quarter sales in the Detroit office.

BEYOND THE BASICS

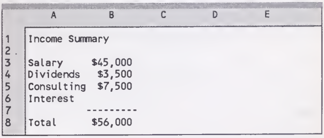
Consider a few other applications of the File Combine commands. Then dream up some of your own.

Pull In a Range of Values The examples you've seen so far have combined entire files. But you'll often want to combine only a cell or a range from the source file into the target file.

For example, suppose you have two worksheets like those shown below. One lists interest-producing income, and another summarizes total income. You want to pull the total from the Interest-Producing Income worksheet into the Income Summary worksheet.



```
     A          B          C          D          E
1  Interest-Producing Income
2                                 Annual
3  Type      Investment Interest Return
4  CD 1         $15,000      8.0%  $1,200
5  Bond 1       $10,000      5.5%    $550
6  Bond 2       $12,000      4.8%    $576
7                                ---------
8  Total                           $2,326
```



```
     A          B          C          D          E
1  Income Summary
2
3  Salary      $45,000
4  Dividends    $3,500
5  Consulting   $7,500
6  Interest
7            ---------
8  Total       $56,000
```

To build the Interest-Producing Income file, begin in a blank worksheet. Select /Worksheet Column Set-Width (in *Symphony*, MENU Width Set) to set the width of column B to 11. Select /Range Format (in *Symphony*, MENU Format) to format ranges B4..B6 and D4..D8 for currency with no decimal places and range C4..C6 for percent with one decimal place. Enter the labels shown. Enter a backslash and a hyphen in cell D7. Enter the values in range B4..C6. Select /Range Name Create (in *Symphony*, MENU

Range Name Create) to assign the range name *total* to cell D8. Enter the formula +B4*C4 in cell D4. Copy cell D4 to range D5..D6. Enter the formula @SUM(D4..D6) in cell D8. Save the file under the name INTEREST.

To build the Income Summary file, begin in a blank worksheet. Select /Worksheet Column Set-Width (in *Symphony*, MENU Width Set) to set the width of column A to 11. Select /Range Format (in *Symphony*, MENU Format) to format range B3..B8 for currency with no decimal places. Enter the labels as shown. Enter a backslash and a hyphen in cell B7. Enter the values in range B3..B5. Enter the formula @SUM(B3..B6) in cell B8. Save the file under the name INCOME.

Position the pointer on cell B6. Select /File Combine Add Named/Specified-Range. Enter the range name *total*. Then specify the file named INTEREST. In *Symphony* select SERVICES File Combine Add Named-Area, enter the range named *total*, select Ignore Values, and specify the file named INTEREST. The value $2,326 appears in cell B6, and the formula in cell B8 correctly calculates your total income as $58,326.

Adjust Absolute References You may occasionally want to copy formulas containing absolute references to another part of the worksheet. But simply copying the formulas won't cause the absolute references to adjust. Instead, extract the formulas to a new file, and then use the File Combine Copy command to bring them into the desired locations. That way, all cell references, even those that are absolute, adjust.

Consider the following example. To build the model, begin in a blank worksheet. Select /Worksheet Column Set-Width (in *Symphony*, MENU Width Set) to set the widths of columns C and E to 4. Select /Range Format (in *Symphony*, MENU Format) to format ranges B2..B6 and D2..D6 for currency with no decimal places and range C2..C4 for percent with no decimal places. Enter the labels as shown. Enter a backslash and an equal sign (\=) in cell B5. Enter the values in ranges B2..B4 and D2..D4. Enter the formula @SUM(B2..B4) in cell B6. Copy range B5..B6 to cell D6. Enter the formula +B2/$B$6 in cell C2. Copy cell C2 to range C3..C4.

COMBINING FILES IN FIVE EASY STEPS

1. Prepare the files for combining. Look over the data in the files to make sure it appears in a similar format. For example, values to be combined should be in either columns or rows in all files, not in rows in some files and columns in others. If you wish, assign names to the ranges to be combined. Write down the named ranges so that when you're in the midst of combining files, you'll remember them.

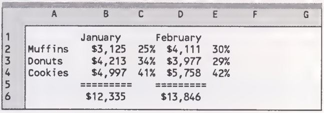
2. Retrieve the target file. If you make any changes to the target file after retrieving it, save it *before* combining other files into it. Then if something goes wrong, you can begin again.

3. Position the cell pointer in the upper-left-corner cell of the range that is to receive the data from the source file. You may lose data if you position the pointer improperly.

4. Issue the File Combine command. If you get bizarre results, do not save the file. Instead, retrieve the target file and begin again.

5. After obtaining the results you want, save the file under a new name.

Looking at the figure, you see that column B contains sales totals for a series of items. Column C contains formulas that calculate the percentage of total sales that each item represents. The formula in cell C2 is +B2/$B$6; in cell C3, it is +B3/$B$6; and so on. Suppose you need this type of formula in column E. Rather than rewrite the formulas, simply select /File Xtract Formulas (in *Symphony*, SERVICES File Xtract Formulas) and specify a new file name, such as TEMP. Then specify range C2..C4. Next move the cell pointer to cell E2. Select /File Combine Copy Entire-File (in *Symphony*, SERVICES File Combine Copy Entire-File Ignore Formulas) and specify the file named TEMP. The column of formulas appears, and the cell references have adjusted. For example, cell E2 contains the formula +D2/$D$6.



```
         A          B     C      D      E        F        G
1               January       February
2   Muffins      $3,125  25%  $4,111  30%
3   Donuts       $4,213  34%  $3,977  29%
4   Cookies      $4,997  41%  $5,758  42%
5               =========     =========
6               $12,335       $13,846
```

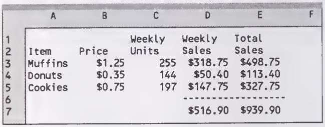
Manage Large Applications Sooner or later, everyone creates an application that gobbles memory or recalculates sluggishly. When that occurs, search for segments of the application that you use infrequently and can extract into a separate file.

For example, a budget application may contain calculations that analyze quarterly performance. If you perform that analysis only once a quarter, use the File Xtract command to extract that portion of the worksheet into a separate file. Then, when it's time to perform the analysis, you can use the File Combine commands to recombine the two files.

If you use *1-2-3* and the extracted data contained any necessary named ranges, be sure to rename them when you are through recombining the files. If you use *Symphony*, specify the Read option when you combine the files. Then all named ranges will be brought in along with the data.

Accumulate Totals You can use the File Combine Add command to create an "accumulator" worksheet. Consider the following example. Suppose you want to evaluate only two columns, one for weekly sales and one for total sales.

To build the model below, begin in a blank worksheet. Select /Worksheet Column Set-Width (in *Symphony*, MENU Width Set) to set the width of column E to 10. Select /Range Format (in *Symphony*, MENU Format) to format ranges B3..B5 and D3..E7 for currency with two decimal places. Enter the labels as shown. Enter a backslash and a hyphen in cell D6, and copy it to cell E6. Enter the values in ranges B3..C5 and E3..E5. Enter the formula +B3*C3 in cell D3. Copy cell D3 to range D4..D5. Enter the formula @SUM(D3..D5) in cell D7. Copy cell D7 to cell E7.



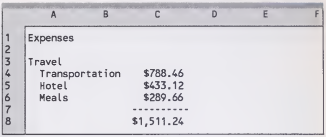
```
      A         B         C         D         E        F
1                       Weekly    Weekly    Total
2   Item      Price     Units     Sales     Sales
3   Muffins     $1.25       255   $318.75   $498.75
4   Donuts      $0.35       144    $50.40   $113.40
5   Cookies     $0.75       197   $147.75   $327.75
6                                 ------------------
7                                 $516.90   $939.90
```

You enter weekly unit sales in column C. A simple multiplication formula in column D automatically calculates weekly sales. Column E, the "accumulator" column, records the running totals.

Let's assume that you just entered the weekly sales data and want to determine the total sales. Select /File Xtract Values (in *Symphony*, SERVICES File Xtract Values) and enter a new file name, such as TOTAL. Specify range D3..D5 as the extract range. Then position the pointer in cell E3. Select /File Combine Add Entire-File (in *Symphony*, SERVICES File Combine Add Entire-File Ignore Formulas) and specify the file named TOTAL. The total for each item is updated, and total sales for all items now equals $1,456.80.

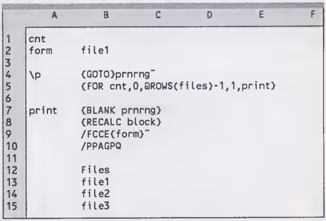
Change Formulas into Values In *1-2-3* Release 1A there's only one way to turn ranges of formulas into their current values: Use the File Combine command. Suppose a worksheet named SALES contains formulas in range C2..C11. To turn the formulas into values, use the File Xtract Values command. Specify a new file name for the extracted file—for example, TEMP—and specify range C2..C11 as the extract range. Then position the pointer in the upper-left cell of the range to be changed into values, in this case, cell C2. Use the File Combine Copy Entire-File command, and specify the file containing the extracted values, in this case, TEMP. The formulas convert to their values. In *1-2-3* Release 2/2.01 use the Range Value command to do this. In *Symphony* use the Range Values command.

Zero Out a Worksheet Form You can use the File Combine Subtract command to "zero out" a worksheet form. Suppose you must prepare a monthly expense report like that shown at the top of the next column. Rather than manually erasing the prior month's data or entering new data in place of old data, just subtract the worksheet from itself. By doing so, you keep all formulas intact, but all values become zero.



```
      A         B         C         D         E        F
1   Expenses
2
3   Travel
4     Transportation    $788.46
5     Hotel             $433.12
6     Meals             $289.66
7                     ----------
8                     $1,511.24
```

Print Multiple Files Finally, you can use a *1-2-3* Release 2/2.01 or *Symphony* macro like the one shown below to print multiple files automatically.



```
      A         B         C         D         E        F
1   cnt
2   form      file1
3
4   \p        {GOTO}prnrng~
5             {FOR cnt,0,@ROWS(files)-1,1,print}
6
7   print     {BLANK prnrng}
8             {RECALC block}
9             /FCCE{form}~
10            /PPAGPQ
11
12            Files
13            file1
14            file2
15            file3
```

To create the macro, enter labels as shown. Leave cell B2 blank for now. In *Symphony* replace the labels in cells B9 and B10 with the labels {SERVICES}FCCEIF{form}~ and {SERVICES}PAGPQ, respectively. Use the Range Name Labels Right command to assign the labels in column A as names for the adjacent cells of column B. Also, assign the name *block* to range B1..B2 and the name *prnrng* to encompass a blank area of the worksheet (starting with column F or G) that is big enough to contain the largest of the files you wish to print.

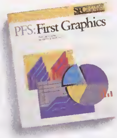
Replace the labels *file1, file2*, and *file3* in range B13..B15 with your own list of file names. Your list need not be limited to three files. However, with this particular macro, all the files you wish to print must reside in your spreadsheet's default data directory.

Assign the name *files* to encompass all the names in the list, then enter the formula @INDEX(files,0,cnt) into cell B2. Finally, select /Print Printer Range, enter *prnrng*, and select Quit (in *Symphony* select SERVICES Print Settings Source Range, enter *prnrng*, and select Quit Quit).

Make sure your printer is turned on. To run the macro, hold down the MACRO key (Alt on most computers) and press P. Should you wish to print a new selection of files, replace the file names in your list, then reassign the range name *files* to encompass all the names in the new list. Do not delete the range name before you reassign it or you'll disable the formula in cell B2 and the macro may not print all the listed files. ■

Phyllis A. Sharon is LOTUS*'s associate editor of features.*

Now you don't need a lot of dough to make a great pie.



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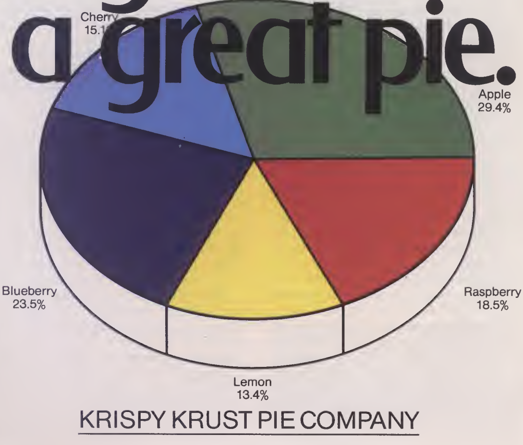

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BILL O'CONNELL

One executive information system user, Terry Cohen, senior vice president of Human Resources at Unum Life Insurance Co., keeps close tabs on employee headcounts.

THE NEW EXECUTIVE INFORMATION SYSTEMS

They're changing the way managers manage.

BY STEVE STECKLOW

At Xerox Corp. in Stamford, Conn., senior executives no longer thumb through thick monthly reports to find a division employee count, the latest budget-versus-actual numbers, and other key information. Instead, they turn on their desktop computers and electronically retrieve whatever data they need.

At Unum Life Insurance Co. in Portland, Maine, the chief executive officer no longer has to telephone the claims department to find out how many claims the company paid out the previous day. Now he gets the answer immediately by clicking a mouse button.

And at Grumman Data Systems in Bethpage, N.Y., the division president no longer calls in all of his vice presidents once a month for a lengthy presentation on the company's latest performance figures. Now, all of the information—profits, new business opportunities, hiring projections, hiring and firing statistics, and more—is available on-line.

These top executives are reaping the benefits of an executive information system (EIS), a new breed of customized database-reporting software that is bringing many PC-leery corporate leaders into the computer age for the first time. These executives are now pushing mice around their desks or pointing at touchscreens to keep tabs on the competition, communicate with managers, and plot new business strategies with fresh insight.

"It has definitely caught on," says David De Long, a research associate at Harvard Business School and coauthor of *Executive Support Systems: The Emergence of Top Management Computer Use* (Dow Jones-Irwin, 1988). Adds Clare Gillan, a senior industry analyst who follows EIS for International Data Corp., "The technology is there, the interest is there, and the need is there."

While experts believe that only about 10% to 15% of corporate executives regularly use computers, they expect the number to grow sharply in coming years, as competitive pressures force executives to obtain critical information more quickly.

Already, sales of EIS development software are beginning to boom, analysts say. International Data Corp. projects that sales will climb from the 1987 figure of $22 million to $115 million by 1992. An EIS development package generally consists of a collection of software tools that an organization's own programming staff uses to create a custom EIS. The development system allows programmers to create an EIS that can, for example, fetch data from the company mainframe and present multidimensional, timely reports. The report information is easy to grasp because it is usually displayed clearly in graphs, tables, and charts.

NO SHORTAGE OF SOFTWARE

At the moment, more than a dozen vendors are selling EIS development software, and new vendors are entering the market every year, according to Alan Paller, editor of *EIS Conference Report*, a newsletter that follows the market. In July 1988, IBM announced an agreement to sell software designed by Comshare (Ann Arbor, Mich.), a leading EIS software vendor. And in December, at an EIS conference in Washington, D.C., Apple Computer mentioned that three companies are designing new systems based on Apple's *HyperCard* program for the Macintosh.

Meanwhile, EIS prices are starting to fall. While the most popular systems today cost at least $130,000 to install—including software, hardware, and customized program development—some new EIS products cost considerably less. American Information Systems (Wellsboro, Pa.) recently released *RediMaster*, a PC-based EIS development package that retails for less than $1,000.

Despite the hoopla about EIS, management consultants and other experts caution that unless a system is well designed and effectively used, it can prove to be a poor investment. "Very few off-the-shelf EIS's are successful," says Michael S. Scott Morton, a professor at the Massachusetts Institute of Technology's Sloan School of Management.

For nearly every anecdote about an executive gleaning some dramatic revelation about his business, experts can recite a horror story about an extravagantly expensive EIS that either provided useless information or simply gathered dust. At Combustion Engineering, a power-plant equipment manufacturer in Windsor, Conn., 45 high-level executives have executive information systems on their desks. But "only a handful" log on every day, says William Dunakin, the manager in charge of the systems.

WHAT EIS PROFESSIONALS WORRY ABOUT

At EIS'88, a conference on executive information systems, delegates were asked to rank their greatest concerns about implementing a system in their organization. The following list is a summary of their responses, ranked in order of importance:

1. Getting executives to specify what they want
2. Making sure EIS data is accurate
3. Combining data from multiple sources
4. Having sufficient staff and computer resources to support the EIS
5. Finding a problem big enough for the EIS system to have real impact
6. Making sure executives have enough time to use the system
7. Keeping abreast of executives' changing needs and desires
8. Avoiding political foot-dragging and back-stabbing
9. Dealing with executives' dislike of technology
10. Deciding what hardware and software to use

Dunakin attributes the systems' poor showing to the fact that they were promoted "from the bottom up rather than from the top down." Employees in a research and development project came up with the idea of designing an EIS and presented it to management. Corporate executives gave the go-ahead, but only a few were willing to gather information with a computer rather than with phone calls and meetings. "Some people would rather interact with people than with a computer," says Dunakin.

Combustion Engineering's experience is not unusual, experts say. *Business Week* reported that the same thing happened at Coca-Cola Co. in Atlanta and at the General Services Administration in Washington, D.C. Unless an EIS has at least one powerful sponsor in the corporate hierarchy—a high-level executive who is willing to learn it and then promote it actively among his peers—the system is probably doomed to failure, experts say.

"An executive support system is for people who are willing to invest the time in making it work for them," says De Long. "These systems take a lot of time to learn, and spare time is not something most executives have."

Pat Walsh, lead systems analyst at Unum Life, says the company's EIS has been successful because its main proponent was Unum's chairman and chief executive, James F. Orr III. Although the system was initially designed to meet Orr's specific needs, "it's beginning to become attractive to other senior executives," says Walsh.

Experts agree that one critical, but often overlooked, requirement of a successful EIS is that it provide information that executives really need. "Only a system that provides time-critical information will be used consistently," says Paller. He adds that many executives end up using only the electronic-messages feature of an EIS.

A common mistake made by MIS (management information system) departments, says De Long, is trying to implement the same EIS for different groups of executives in a corporation. "The vice presidents of finance, marketing, and sales will all have different information needs and different learning styles," he says. "Some people talk on the phone all day, others study numbers, others look only at graphs."

As a result, say De Long and other EIS experts, a system must not only be customized for an organization, it must be customized for each executive. Many successful systems also provide different levels of reports for not only top executives but middle managers, as well. Says David Friend, chairman of Pilot Executive Software (Boston), an EIS software developer, "The guy who gets the senior executive's call asking 'Why are sales down in California?' needs access to the EIS data too."

COMMUNICATION IS PARAMOUNT

The system designers must spend time talking to executives to learn their individual information needs, and the programmers must make clear to the designers and executives what information is available. Comshare, which sells an EIS development package called *Commander*, recommends asking executives two questions: What information do you want to see after you return from a long vacation and What information would be most damaging if your competitors got hold of it?

Unfortunately, say experts, at some corporations executives have trouble communicating their needs to EIS managers. "EIS systems may require a line of communication that may not currently exist in the corporate culture," says Jeanne Alvarez, spokeswoman for Pilot Executive Software. "It's important to find a person within a company who can communicate with both the MIS department and the executive office," she says.

Another challenge for EIS designers is to make the system less threatening to computerphobic executives. While younger business school graduates are generally accustomed to using computers, older executives are often uncomfortable with PCs. To make the systems friendlier, nearly all executive information systems feature colorful interfaces with icons and pull-down menus, as well as easy-to-read graphics and reports.

Because few senior executives like to use keyboards, most systems work with a mouse or a touchscreen. Rich Tuttle, spokesman for Execucom Systems Corp. (Austin, Tex.), an EIS software developer, says his company's most popular input device is an infrared touchpad that resembles a television remote-control unit and can work up to 25 feet away. "It's less intimidating," he says.

But even if an executive regularly uses an EIS, that does not necessarily mean the system is successful. "Sometimes, if you customize a system for individual managers, you only address individual concerns instead of corporate issues," Friend says.

In addition, an EIS should be more than just electronic information gofers. According to Gary Gulden, a management consultant with the Index Group (Cambridge, Mass.), savvy executives should use a system to implement change within their corporations. "But," he adds, "most senior executives don't view executive information systems as tools to change people's perspectives and behavior or the structure of their organization."

Harvard's De Long agrees with Gulden about the importance of these systems. "The real payoff," he says, "is when the technology changes the way an executive thinks about the business." ■

Steve Stecklow is a reporter for the Philadelphia Inquirer *and a frequent contributor to* LOTUS.

A SAMPLING OF EIS SOFTWARE DEVELOPERS

The following organizations sell executive information systems. The numbers in parentheses indicate the estimated number of corporate installations.

Cadet (20), Cadet Executive Information Systems, P.O. Box 4545, Atlanta, GA 30302; contact Ron Ferrero, 404-526-6251.

Command Center (150), Pilot Executive Software, 40 Broad St., Boston, MA 02109; contact David Houpert, 617-350-7035.

Commander EIS (200), Comshare, 300 South State, Ann Arbor, MI 48108; contact Chris Kelly, 800-922-7979 (in Mich., 313-994-4800).

Custom ESS (10), Booz, Allen & Hamilton, 209 Burlington Rd., Bedford, MA 01730; contact Alan Greif, 617-275-2225.

Easel (60), Interactive Images, 600 West Cummings Park, Woburn, MA 01801; contact Robert Gleason, 617-938-8440.

EIS Pak (40), Computer Associates International, 10505 Sorrento Valley Rd., San Diego, CA 92121; contact Richard Kreysar, 800-841-3734 (in Calif., 800-468-0725).

Encore! Plus (10), Ferox Microsystems, 1701 North Fort Myer Dr., Suite 1205, Arlington, VA 22209; contact Rusty Luhring, 703-841-0800.

Executive Edge (10), Execucom Systems Corp., 9442 Capital of Texas Highway N, Arboretum Plaza One, Austin, TX 78759; contact Mark Wood, 800-531-5038 (in Tex., 512-346-4980).

Metaphor Data Interpretation System (175), Metaphor Computer Systems, 1965 Charleston Rd., Mountain View, CA 94043; 800-255-5803.

pc Express (40), Information Resources, 200 Fifth Ave., Waltham, MA 02154; contact Gary Farner, 617-890-1100.

RediMaster (22), American Information Systems, P.O. Box 367, Wellsboro, PA 16901; contact Clint Kreitner, 717-724-1588.

Resolve (107), Metapraxis, 900 Third Ave., New York, NY 10022; contact Robert Bittlestone, 212-935-4322.

BY EVERETTE S. GARDNER JR.

HOW TO MONITOR YOUR FORECASTS

This simple technique tells you if your forecasting model is still doing the job it was created for.

Over the past few years we've discussed a variety of forecasting models in these pages, from simple exponential smoothing to linear regression. It is important to remember, however, that once you implement one of these models, you can't expect it to supply good forecasts indefinitely. The pattern of the data may change. If this happens, you will either have to adjust your forecasting model or select a new model better suited to your data.

Suppose you're using simple exponential smoothing, a model that assumes that the mean value of the data is relatively constant. For example, during the first months in which you sell a product, you have good months and bad months, but the sales figures are essentially centered around the average.

Assume that a trend develops—for example, after six months your product catches on and sales start to skyrocket. Now you're in trouble because your forecasts cannot keep up with the trend. But how do you detect this problem?

One approach is to test the data periodically for trends and other data problems (see "How to Detect Trends and Seasonal Cycles," May 1988). Another approach is to examine a graph of the forecasts each time you add new data to your model. Both methods quickly become tiresome, especially when you forecast numerous data sets each month. I am familiar with one company in Houston that uses worksheet models to forecast more than 1,000 data sets each month. Checking all of this data every month would be out of the question.

What you need is a fast, simple way to monitor the quality of your forecasts. The tracking signal, a simple quality-control model, is just the tool for the job. Specifically, you must set up a range of tracking-signal formulas in your forecast spreadsheet to let you know if your forecasts deviate too much from actual values.

To understand how this technique works, let's start with the definition of a forecast error:

Forecast error =
Actual data − Forecast

When a forecast for a given period is too high, the error will be negative. When a forecast is too low, the error will be positive. Ideally, the forecasts will fluctuate around the actual data, and the sum of the errors will be zero. But if the sum of the errors departs from zero in either direction, the forecasting model may very well be out of control.

How far should you let the sum of the errors grow before you panic? To answer this question, you need a basis for comparison, that is, a measure of the dispersion, or scatter, of the forecast errors. If the errors are widely scattered, then a relatively large sum of errors doesn't necessarily indicate a problem. You can use the standard deviation to measure dispersion. I prefer using the mean absolute error (MAE) because it's easier to compute. We'll look at how to compute MAE a little later in the article.

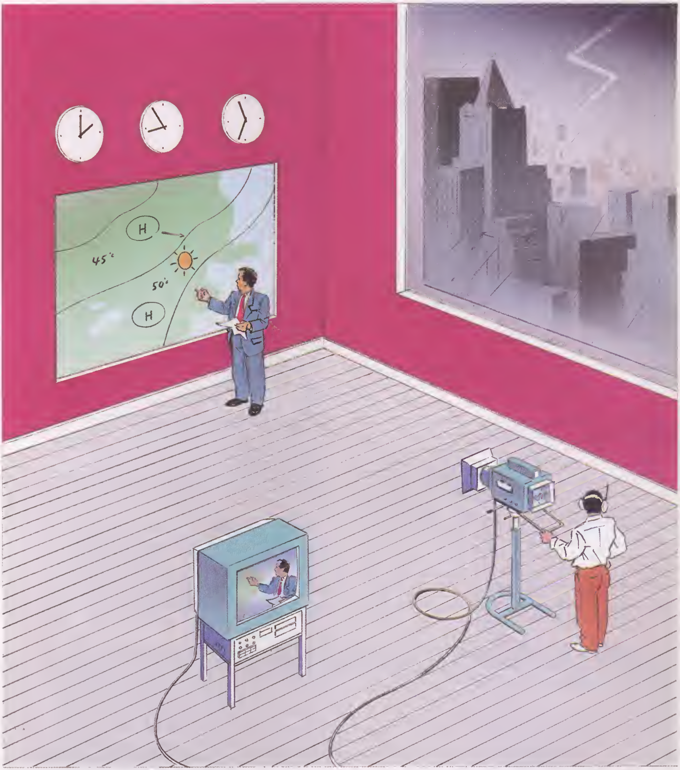
The tracking signal is defined as the following ratio:

$$\text{Tracking signal} = \frac{\text{Sum of errors}}{\text{Mean absolute error}}$$

Once you've computed a tracking signal, you watch to see if its absolute value exceeds a control limit that you enter in a specific cell in your forecast worksheet. Absolute value simply means that if a value has a minus sign, the sign is dropped. Typically, the control limit is set at ±4.0; that is, the tracking-signal formulas will indicate a problem if the ratio defined above is greater than 4.0 or

---

Everette S. Gardner Jr. is associate professor of decision and information sciences at the University of Houston, director of the International Institute of Forecasters, and coauthor of Quantitative Approaches to Management, *seventh edition (McGraw-Hill, 1989).*



MIN JAE HONG

less than −4.0. If the ratio goes outside this range, you should investigate; otherwise, you can continue using your forecasting model. There is a very small probability, less than 1%, that the signal will go outside the range ±4.0 due to chance.

To illustrate how a forecasting technique can outlive its usefulness, figure 1 shows a graph of actual sales, indicated by the solid line, and forecasts produced by simple exponential smoothing, indicated by the Xs. For the first six months, the forecast errors are relatively small. Then a strong trend begins in the seventh month, and the forecast values start to fall short of the actual values.

Fortunately, it's not necessary to create a graph to see this happen. In the worksheet in figure 2, the formulas in column H start to return values greater than 4.0 in the seventh month. To make the problem even easier to spot,

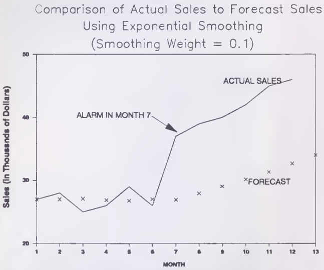


FIGURE 1. This graph shows that when an upward trend in actual sales developed, the method used to generate forecast values, denoted by the Xs, was no longer appropriate.

the formulas in column I return the character string ALARM whenever the absolute value of the adjacent cell in column H is 4.0 or higher.

THE SELF-MONITORING FORECAST WORKSHEET

Create the worksheet from the instructions in the box on the opposite page. Then we'll take a step-by-step look at the workings of a monitored forecasting model. We'll also review the forecasting formulas for those unfamiliar with the exponential-smoothing technique. If you want more information on exponential smoothing, see the February and March 1987 issues of *LOTUS*.

Step 1: Compute the monthly forecasts and errors. After you enter the month numbers and actual sales values in columns A and B, you get the smoothing process started by placing the first forecast in cell C7. A rule of thumb is to set the first forecast equal to the first actual-data value. That's why you enter the formula +B7 in cell C7.

As you saw earlier, you compute forecast error by subtracting the forecast value from the actual value, so you enter the formula +B7−C7 in cell D7 and copy this down column D. Subsequent forecasts are obtained by multiplying the previous period's error by the smoothing weight (to be explained shortly) and then adding the result to the previous forecast. Therefore, you enter +C7+D7*$weight in cell C8 and copy the formula down column C. Because the actual sales figure is not yet available for the 13th month, leave cells B19 and D19 blank.

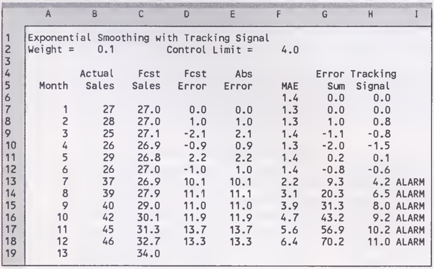
Exponential smoothing works by adjusting the forecasts in response to the error, much like a thermostat, an automatic pilot, or cruise control on an auto. Examine the way the forecasts change with the errors. The first-month error is zero, so the second-month forecast is unchanged. The error is positive in the second month, so the third-month forecast goes up. The third-month error is negative, so the fourth-month forecast goes down.

The amount of adjustment each month is controlled by the smoothing-weight value in cell B2. A low weight value keeps the forecast from overreacting to purely random changes in the data. But a low weight value also means that the forecasts are slow to react to true changes. A high weight value has just the opposite effect—your forecasts react quickly to both randomness and true changes. Some experimentation is always necessary to find the best weight for your data.

Step 2: Compute absolute errors and mean absolute errors. Formulas in column E return the absolute values of the forecast errors. This explains why you enter @ABS(E7) in cell E7 and copy this down column E.

The mean absolute errors in column F are updated via exponential smoothing much like the forecasts. You must first compute a starting value for the MAE in cell F6. This should be representative of the errors, or the tracking signal can give spurious results.

A rule of thumb is to use the average of all available



```
          A        B        C        D        E        F        G        H        I
 1   Exponential Smoothing with Tracking Signal
 2   Weight =    0.1          Control Limit =     4.0
 3
 4              Actual     Fcst     Fcst      Abs              Error Tracking
 5     Month     Sales    Sales    Error    Error      MAE      Sum   Signal
 6                                                     1.4      0.0      0.0
 7         1        27     27.0      0.0      0.0      1.3      0.0      0.0
 8         2        28     27.0      1.0      1.0      1.3      1.0      0.8
 9         3        25     27.1     -2.1      2.1      1.4     -1.1     -0.8
10         4        26     26.9     -0.9      0.9      1.3     -2.0     -1.5
11         5        29     26.8      2.2      2.2      1.4      0.2      0.1
12         6        26     27.0     -1.0      1.0      1.4     -0.8     -0.6
13         7        37     26.9     10.1     10.1      2.2      9.3      4.2 ALARM
14         8        39     27.9     11.1     11.1      3.1     20.3      6.5 ALARM
15         9        40     29.0     11.0     11.0      3.9     31.3      8.0 ALARM
16        10        42     30.1     11.9     11.9      4.7     43.2      9.2 ALARM
17        11        45     31.3     13.7     13.7      5.6     56.9     10.2 ALARM
18        12        46     32.7     13.3     13.3      6.4     70.2     11.0 ALARM
19        13               34.0
```

FIGURE 2. This worksheet forecasts sales using the exponential-smoothing method. The forecasts appear in column C. Each formula in column H divides the column-G value on its row by the column-F value on its row. Note that each formula in column G sums the actual errors (not the absolute errors) from row 7 to the row on which the formula resides. Finally, the formulas in column I return the string ALARM when the tracking-signal formula on its row returns an absolute value higher than the control-limit value in cell B2. In *1-2-3* Release 1A, the formulas return +++++ instead of ALARM.

errors to start the MAE. Assume that you created this worksheet back when you had the actual sales values only through the sixth month. Based on this, you enter the formula @AVG(E8..E12), which returns the average of the absolute errors for the second through sixth months. The absolute error for the first month is excluded, since its value is always 0.

You compute subsequent MAEs by subtracting the smoothing weight from one, multiplying the previous MAE by that difference, and adding to that result the product of the current period's absolute error multiplied by the smoothing weight. Therefore, the formula in cell F7 is +F6*(1−$weight)+E7*$weight. The result is really a weighted average of the MAE, which adapts to changes in the scatter of the errors.

Step 3: Sum the errors. This operation appears as a separate step because a mistake here would be disastrous. You must sum the unadjusted errors in column D, not the absolute errors. If you sum the absolute errors, the error-sum column could give plausible-looking, but entirely inaccurate, results. The only logical starting value is 0, which you entered in cell G6. Cell G7 contains the formula @SUM(D$7..D7), which is copied down column G. Each formula sums the values in column D from cell D7 to the cell in its own row.

Step 4: Compute the tracking signal. The tracking-signal formulas in column H simply return the ratios of the error-sum values to the MAE values on their respective rows. The ratios are included in an @IF function to prevent division-by-zero errors. Cell H6 contains the formula @IF(F6=0,0,G6/F6). This formula is copied down column H.

Step 5: Enter the formulas that signal ALARM. Column I contains string-returning formulas that return the string ALARM if the tracking signals on their respective rows have an absolute value greater than the control-limit value you entered in cell F2. In *1-2-3* Release 1A, the formula returns five plus signs to indicate a problem.

ADAPTING THE TECHNIQUE TO YOUR OWN FORECASTS

The formulas in columns E through I are not specific to simple exponential smoothing. They can be combined with any other forecasting worksheet as long as the actual (not absolute) period-by-period errors are listed in a column. If you are using a forecasting model that does not include weights, such as linear regression, you will have to select a weight (such as 0.1) to use in the MAE formulas. Although you should be concerned with the weights used to update forecasts, there is not much to gain by experimenting with the weights in the MAE.

In figure 2 the tracking signal gives an immediate warning that the forecasts are out of control. Don't expect this to happen every time. The tracking signal is by no means a perfect quality-control device, and only drastic changes in the data will cause immediate warnings. More subtle changes may take some time to detect.

The exact probability that the tracking signal will go outside the range ±4.0 depends on many factors, such as the type of data, the forecasting model in use, and the parameters of the forecasting model, such as the smoothing weights. Control limits of ±4.0 are a good starting point for tracking most business data. If your experiments show that these limits miss important changes in your data, reduce them to 3.5 or 3.0. If the signal gives false alarms, in other words, cases where the signal is outside the limits but there is no apparent problem, increase the limits to 4.5 or 5.0. ■

HOW TO SET UP THE WORKSHEET

1. Default settings

Format: Fixed, 1
1-2-3: /Worksheet Global Format Fixed, enter 1
Symph: MENU Settings Format Fixed, enter 1, Quit

Column width: 8
1-2-3: /Worksheet Global Column-Width, enter 8
Symph: MENU Settings Width, enter 8, Quit

2. Cell formats

Format	**Range**
General	A7..B19
+/−	I6 (*1-2-3* Release 1A only)

1-2-3: /Range Format General, indicate range A7..B19
Symph: MENU Format General, indicate range A7..B19

3. Labels

Enter the labels shown in figure 2 in cells A1, A2, and D2 and in rows 4 and 5. Right-align the labels in rows 4 and 5: Select /Range Label Right (*Symph*: MENU Range Label-Alignment Right), specify range A4..H5.

4. Values

Enter the values shown in figure 2 in cells B2, F2, and G6, and in range A7..B19.

5. Range names

Name	**Range**
weight	B2
control	F2

For example, to assign the range name *weight* to cell B2, press slash (*Symph*: MENU), select Range Name Create, enter *weight*, indicate cell B2.

6. Enter and copy formulas

Cell	**Formula**
C7	+B7
C8	+C7+D7*$weigh

Copy cell C8 to range C9..C19.

Cell	**Formula**
D7	+B7−C7
E7	@ABS(D7)

Copy range D7..E7 to range D8..D18.

Cell	**Formula**
F6	@AVG(E8..E12)
F7	+F6*(1−$weight)+E7*$weight

Copy cell F7 to range F8..F18.

G7 @SUM(D$7..D7)

Copy cell G7 to range G8..G18.

Cell	**Formula**
H6	@IF(F6=0,0,G6/F6
I6	@IF(@ABS(H6)>$control,"ALARM","")

Alternate formula for *1-2-3* Release 1A
I6 @IF(@ABS(H6)>$control,5,0)

Copy range H6..I6 to range H7..H18.

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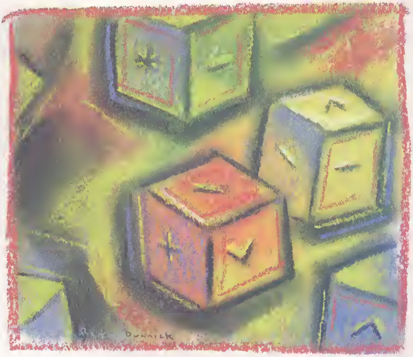
A BEGINNER'S GUIDE

SOME FORMULA FUNDAMENTALS

Learn these basic rules and techniques and you'll soon be writing your own formulas. By Peter G. Aitken



The mathematical formulas you enter into your spreadsheet allow you to manipulate and analyze numerical data in a variety of ways. Formulas can range from simple to complex. Those new to spreadsheets often find formulas confusing. If you've used a hand calculator, however, you have a head start in understanding how *1-2-3* and *Symphony* use mathematical formulas. The basics of performing calculations with a calculator are the same as the basics of writing a formula. Learn the following formula fundamentals and you'll be able to write simple formulas for your worksheets.

You enter formulas in worksheet cells the same way you enter values and labels. When you enter a formula, begin it with a number or with one of the following characters, which tell *1-2-3* and *Symphony* that the entry that follows is a formula:

+ – (@ . # $

A formula can contain one or more of four basic components: operators, values, cell references, and @functions. We'll look briefly at each.

Operators instruct *1-2-3* and *Symphony* to combine and manipulate numbers in certain ways. The following table lists the seven mathematical operators, names their uses in a formula, and illustrates how they are used.

Operator	Use	Example
^	exponentiation	2^3 (2 to the 3rd power)
–	negative sign	–2 (negative 2)
+	positive sign	+2 (positive 2)
*	multiplication	10*20 (10 times 20)
/	division	10/20 (10 divided by 20)
–	subtraction	4–2 (4 minus 2)
+	addition	4+2 (4 plus 2)

Values are the numbers and constants you include in formulas. To include values in a formula, enter them exactly as you wish them to appear. The following formulas contain values and operators. The results returned by these simple formulas are also shown.

Formula	Result Returned
200/10	20
1+2+3+4	10
2^4	16
1000–1200*0.15	820

In the last formula, the multiplication operation occurs before the subtraction operation. We'll talk more about this in a minute.

Cell references enable you to use a value that is in another cell in your current formula; you enter the cell's address in the formula. For example, if cell A10 contains the value 5, the formula 10+A10 placed in any other cell in the worksheet will return the value 15. If the referenced cell is blank or contains a label, it is evaluated as zero in *1-2-3* Releases 1A and 2.01. In *1-2-3* Release 2 and all releases of *Symphony*, if a mathematical formula refers to a cell that contains a label, the formula returns ERR. When a cell reference is the first (or only) element in a formula, precede it with either a plus sign or a minus sign.

@Functions are the built-in mathematical formulas *1-2-3* and *Symphony* have for many frequently used calculations. They are called "at" functions because the name of each function is preceded by the at symbol (@). Some @functions perform a calculation on a single value. An example is @SQRT(*n*), which calculates the square root of the number *n*. Other @functions perform calculations on cell ranges. An example is @SUM(A1..A10), which determines the sum of cells A1 to A10.

REGAN DUNNICK

The @functions can be used in formulas anywhere you might use a value or cell reference. Much has been written in *LOTUS* about @functions, but a thorough discussion of them here goes beyond the scope of this article. Keep in mind, however, that many @functions are available to perform specialized calculations. Consult your manual for more about them.

PRECEDENCE OF OPERATORS

The programs assign precedence to each mathematical operator. This precedence determines the order in which *1-2-3* and *Symphony* perform mathematical operations. There are seven precedence levels. Operations with higher precedence numbers are performed first. Levels 7 through 4 govern mathematical operations. Levels 3, 2, and 1 govern logical and comparative operations. Here are the precedence levels of the various mathematical operations:

Level	**Operation**
7	exponentiation (^)
6	negative, positive (+ −)
5	multiplication, division (*/)
4	addition, subtraction (+ −)

Operations with the same precedence level are performed left to right as they appear in the formula. For example, in the formula 2+5+4*10^2, the order of operations is as follows:

1. Evaluate 10^2 (equals 100).
2. Multiply the result of step 1 by 4 (equals 400).
3. Add 2 to 5 (equals 7).
4. Add the result of step 3 to the result of step 2 (equals 407).

Sometimes this evaluation order does not give you the desired result. For example, what if you want to add two numbers together and then multiply their sum by a third number? You might write the formula 1+2*3, but because multiplication has a higher precedence than addition, your formula will first multiply 2 by 3, then add the product to 1, giving a result of 7. You can modify the order of evaluation by using parentheses. Enter the formula as (1+2)*3 and the parentheses force the formula to first evaluate 1+2 and then multiply this sum by 3. This yields the correct result of 9.

You can enclose sets of parentheses within one another, or nest them, many levels deep. *1-2-3* and *Symphony* evaluate multiple sets of parenthetical expressions from the inside out. The contents of the innermost parentheses evaluate first, then the next level out, and so on. Consider the following rather complex formula: 2^(7−(2*(1+1))). Here are the steps *1-2-3* and *Symphony* follow in evaluating it:

1. Evaluate 1+1 (equals 2).
2. Evaluate 2*2 (equals 4).
3. Evaluate 7−4 (equals 3).
4. Evaluate 2^3 (equals 8).

Remember, you must balance parentheses within a formula. There must be a close parenthesis for each open parenthesis. If there is not, the computer beeps, and you are not allowed to enter the formula in the cell. Also keep in mind that you can use parentheses to clarify formulas. The two formulas below are evaluated in exactly the same way. The use of parentheses makes the second formula easier to read and understand.

+A1*B1^C1+A2*B2^C2

(A1*(B1^C1)+(A2*(B2^C2)))

RELATIVE AND ABSOLUTE CELL ADDRESSES

Most formulas contain references to the addresses of one or more worksheet cells. The following will illustrate how these references work. Start with a blank worksheet, and put the value 0 in cell A1 and the value 100 in cell B1. Next, enter the formula +A1 in cell A2. As you might expect, cell A2 displays a zero. Now, copy the contents of cell A2 to cell B2: Press slash (in *Symphony*, MENU), select Copy, then press Return to accept cell A2 as the range to copy from. Press Right Arrow and press Return to specify cell B2 as the range to copy to. Cell B2 displays 100 rather than a zero.

1-2-3 and *Symphony* automatically assign relative cell addresses to your formula entries. The formula in cell A2 contains a reference to cell A1. That reference literally means "one cell up." When you copy the formula +A1 from cell A2 to cell B2, the reference "one cell up" stays the same but the notation in the formula changes. Because the copied formula still references "one cell up," the cell now referred to is not cell A1. It is cell B1, the cell "one cell up" from cell B2.

When you write more-advanced formulas, you can use absolute cell addresses. This technique allows you to copy formulas from one part of the worksheet to another while maintaining references to specific cells. For more on the techniques of relative and absolute cell addressing, see "The Absolute Truth About Relative References" in the October 1986 issue or consult your *1-2-3* or *Symphony* manual.

USE THE POINT MODE

Pointing to cells when entering formulas simplifies and speeds the task of entering cell addresses into formulas. Rather than type in the cell addresses, use the cell pointer to indicate the desired cell or cell range. *1-2-3* and *Symphony* automatically enter the corresponding cell address in the formula.

To use Point mode, begin entering the formula in the usual manner by first entering a plus sign. When you need to include a cell address, use the Arrow keys to move the cell pointer to the cell whose address you want to include. The status indicator at the top right of the screen switches from VALUE to POINT, indicating that you are in Point mode. As you move the cell pointer, the control panel shows the formula you've entered so far, incorporating the address of the current cell. When you reach the desired cell, continue entering the formula or end the formula entry by pressing Return. The formula now contains the address of the cell that holds the cell pointer.

To enter multicell ranges in a formula, point to the upper-left corner of the range, and press the period key to anchor the cell pointer on the corner of the range. Then use the Arrow keys to highlight the range. Continue entering the formula or press Return to include the coordinates of the highlighted range in the formula. This technique is especially useful when specifying ranges in @functions.

CONVERTING FORMULAS TO VALUES

In *1-2-3* Release 2/2.01 and *Symphony*, the Range Value command converts formulas to values. You can use this command to copy the displayed values of formulas to another region of the worksheet. Select /Range Value (in *Symphony*, MENU Range Values), specify the range of cells containing the formulas you want to convert to values, and press Return. Specify the To range and press Return. This command copies the displayed values of the formulas in the From range as values, to the To range. You copy value and label cells in the From range unchanged. To replace a range of formulas with their associated values, specify the same From and To ranges. Convert a formula in a single cell to a value by placing the cell pointer on the cell and pressing the EDIT key, the CALC key, and then Return.

INSERTING AND DELETING ROWS AND COLUMNS

When you insert or delete a row or column, cell addresses in formulas automatically adjust to account for the changes. To demonstrate, start with a blank worksheet, enter any value in cell A5 and the formula +A5 in cell A1. Next, move the cell pointer to cell A3 and select /Worksheet Insert Row (in *Symphony*, MENU Insert Rows), then press Return. The value you entered is now in cell A6, and the formula in cell A1 changes to +A6. Delete row 3 and reverse the changes. You make similar formula adjustments when you delete or insert rows or columns within a cell range specified in an @function.

In some cases, such as when you add a new month of data to a forecast or a new record to a database, you must add a column or row to the right or bottom of a range of formulas. In these cases you copy existing formulas into the column or row you've added. If the formulas contain relative cell addresses, *1-2-3* and *Symphony* automatically adjust cell references in the copied formulas. Be aware, however, that the new formulas may be outside the ranges referenced by @functions in formulas elsewhere in the worksheet. Check your worksheet carefully and adjust @function ranges wherever appropriate.

DISPLAYING AND PRINTING FORMULAS

When you view or print a worksheet, you see the values returned by underlying formulas. At times, particularly when troubleshooting a worksheet, it is useful to see some or all of the formulas rather than their resulting values. To view or print underlying formulas, select /Range Format Text (in *Symphony*, MENU Format Other Literal) and specify a range. You can now see formulas, rather than the values they return, in the range specified. You need to increase column width to display long formulas in their entirety.

To produce a printout of formulas, select /Print Printer Options Other Cell-Formulas (in *Symphony*, SERVICES Print Settings Other Format Cell-Formulas). Select Quit Align Go. For each cell in the Print range, a cell address, cell format (if different from the defaults), cell protection status, and contents are printed. In *1-2-3* Release 2/2.01, the cell widths, if different from the default column widths, are also printed.

TRACKING DOWN ERRORS

A common formula error occurs when you mistype a formula entry. You may misspell the name of an @function, forget to close parentheses, or make some other mistake. When you press Return to enter the formula, you hear a beep and find that your spreadsheet is in Edit mode. Take a clue from the position of the cursor. It is usually at or near the location of the error. Examine the formula, find your mistake, and correct it.

Another common formula error occurs during the evaluation of a formula. When you attempt a mathematically impossible operation such as dividing by zero, the cell containing the formula will display ERR, as will any other formula cell in the worksheet that references that cell. Track down this type of error by placing the cell pointer on the cell containing the error-returning formula. Note the cells referenced in the formula. Then systematically examine each cell referenced to see if it contains the error-producing entry. If the formula is a long one, break it into parts and note which part contains the error-producing reference. Turn the problem segment into a label by adding a label prefix to it. Copy it to a convenient location on the worksheet, and view it as needed while you track down the error. ■

Peter G. Aitken wrote about file management in the February issue.

How Many Should You Order?

BY RICHARD CRANFORD

Imagine that you are the inventory manager for Uncle Bunko's Nifty Trick and Novelty Wholesalers. Your job is to make sure the company never runs out of, say, Groucho Marx noses. You must figure out how often and how many items to reorder at a time and also minimize the cost of maintaining the supply on hand.

You could order a week's worth every week to keep the supply topped off. But each time you order Groucho noses from the supplier, you incur expenses for everything from the order form to the labor involved in receiving the order. A company that manufactures what it sells must also consider order costs. Procuring a week's worth of an item from production means that once a week the machine that produces that item isn't producing anything while it's being set up. In a small proprietorship, the cost of placing an order can be a few dollars. In a large corporation, order costs can include computer time and the time of senior executives and can run into the hundreds or thousands of dollars. In either case, larger and less frequent orders are more efficient.

OK, you say, I'll order a year's worth every year. While this might be appropriate for plastic novelty items, it presents some obvious problems for businesses that deal in oranges or gardenias. And although funny noses fall into the nonperishable category, it's still risky to order a year's worth at a time. In six months, Groucho Marx noses may be passé, and there you'd be with six months' worth of stock you can't unload.

Just as there are costs associated with ordering replacements, there are costs associated with keeping inventory in stock. While the former is easier to quantify, the latter is no less real. The cost of holding inventory is called carrying cost. Besides spoilage and obsolescence, carrying costs take into account the effects of inventory taxes, inventory insurance, storage costs, and the cost of capital. Determining carrying cost is tricky, and in the final analysis, the result is just an estimate. Many people hold, however, that the carrying cost of an item ranges between 20% and 30% of its cost.

Obviously, the amount to order is the amount that strikes the best balance between order costs and carrying costs. Another way to express this is to say that the appropriate reorder amount incurs the lowest total cost (the sum of order costs and carrying costs). This amount is the economic order quantity (EOQ).

One way to determine EOQ is to plot the order costs, carrying costs, and total costs for several order quantities on a graph. The point where the order costs and carrying costs cross, which is also the lowest total cost, is the optimal amount to reorder. The second way is to use the formula approach, in which you calculate the optimal reorder amount using your numbers for annual usage, order costs, and carrying costs. You'll soon see how to create a worksheet to determine EOQ with each approach.

The Economic Order Quantity model is a time-tested way to determine cost-efficient reorder amounts.

KRISTEN FUNKHOUSER

THE GRAPHICAL APPROACH

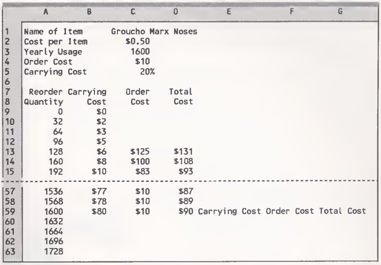
Before reading the next paragraphs, create the graphical approach worksheet shown in figure 1 from the instructions in the "How to Set Up the Worksheets" box.

The worksheet shown in figure 1 is used to create the graph shown in figure 2. Note that several of the worksheet's rows are not shown. This worksheet is designed so that you can enter the item name, per-item cost, yearly usage, order cost, and carrying-cost percentage of any inventory item, then calculate the worksheet, and display a graph showing the EOQ for that item. The following explains the reasoning behind the formulas.

We've entered a zero in cell A9. Each of the remaining formulas in column A takes the value above it and adds one-fiftieth of the annual usage of the item. When we create the graph, we'll be plotting the carrying costs, order costs, and total costs associated with 50 different reorder quantities. This is to insure that the curved line for order costs will be smooth. If we didn't want to see data labels on the graph, these formulas would stop at cell A59, where the formula returns the yearly usage value from cell C3. Instead, the formulas go beyond the yearly usage. Since these values are the X range for the graph, including the four extra values creates some space at the right side of the graph for the data labels. Notice that the values for carrying costs, order costs, and total costs do stop at row 59.

Each formula in column B starts by dividing the reorder quantity to its left by 2. This gives you average inventory, so called because the on-hand amount is assumed to alternate between the amount you order and zero. The formulas then multiply average inventory by the per-item costs to determine the dollar value of average inventory and then multiply that product by the carrying-cost percentage.

We haven't entered any formulas in the first four cells of the *Order Cost* and *Total Cost* columns because plotting these values for very low quantities would make the graph hard to read. The formulas in range C13..C59 divide the yearly usage by the reorder quantities from their respective rows, giving the number of orders per year, and then multiply those by the reorder cost from cell C4.



```
         A         B         C         D              E              F          G
 1   Name of Item      Groucho Marx Noses
 2   Cost per Item        $0.50
 3   Yearly Usage          1600
 4   Order Cost             $10
 5   Carrying Cost           20%
 6
 7    Reorder Carrying     Order    Total
 8   Quantity     Cost      Cost     Cost
 9          0       $0
10         32       $2
11         64       $3
12         96       $5
13        128       $6      $125     $131
14        160       $8      $100     $108
15        192      $10       $83      $93
-------------------------------------------------------------------------------------
57       1536      $77       $10      $87
58       1568      $78       $10      $89
59       1600      $80       $10      $90 Carrying Cost Order Cost Total Cost
60       1632
61       1664
62       1696
63       1728
```

FIGURE 1. This worksheet is used to create the graph shown in figure 2. Several rows are not shown. You enter data pertaining to an inventory item in range C1..C5. Column A computes several possible reorder quantities in increments of one-fiftieth of a year's usage. Columns B through D compute the carrying cost, order cost, and total cost associated with each reorder quantity. These values are plotted on an XY graph, using the values in column A as the X range and the values in columns B, C, and D as the A, B, and C ranges, respectively.

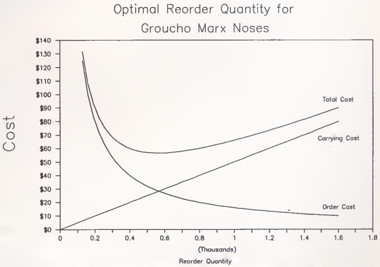


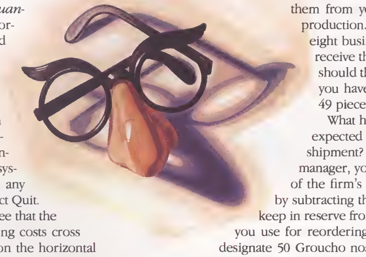
FIGURE 2. This graph shows the annual carrying costs, order costs, and total costs associated with different reorder quantities for an item, ranging from zero to 1,600. The point at which the order-cost and carrying-cost lines cross, which is also where the total-cost line is lowest, indicates the optimal reorder quantity for the item.

Finally, the formulas in range D13..D59 add the carrying costs and order costs in each row.

To create your graph, follow the instructions in one of the next two paragraphs. Note that the graph on your screen may not exactly match the graph in figure 2.

In *1-2-3* select /Graph Type XY. Select X and specify range A9..A63, select A and specify range B9..B59, select B and specify range C9..C59, and select C and specify range D9..D59. Then select Options Format Graph Lines Quit. Select Titles First, enter *Optimal Reorder Quantity for*; select Titles Second, enter *\C1*; select Titles Y-Axis, enter *Cost*; select Titles X-Axis, enter *Reorder Quantity*. Select Data-Labels A, specify range E9..E59, and select Below; select B, specify range F9..F59, and select Above; select C, specify range G9..G59, and select Above. Then select Quit Scale Y-Scale Format Currency, enter a zero, and select Quit Quit View. The graph in figure 2 should appear on your screen. If it doesn't, your computer may not have a display adapter with graphics capability, or *1-2-3* may not have been installed to use your system's graphics capability. Press any key to clear the graph, then select Quit.

In *Symphony* select MENU Graph 1st-Settings Type XY. Select Range X and specify range A9..A63, select A and specify range B9..B59, select B and specify range C9..C59, select C and specify range D9..D59. Then select Quit. Select Format A Lines B Lines C Lines and select Quit. Select Data-Labels A, specify range E9..E59, and select Below; select B, specify range F9..F59, and select Above; select C, specify range G9..G59, and select Above. Then select Quit. Select Switch Titles First, enter *Optimal Reorder Quantity for*; select Second, enter *\C1*; select Y-Axis, enter *Cost*; select X-Axis and enter *Reorder Quantity*. Then select Quit Y-Scale Format Currency, enter a zero, and select Quit Quit Preview. The graph shown in figure 2 should appear on your screen. If it doesn't, your computer may not have a display adapter with graphics capability, or *Symphony* may not have been installed properly to use your system's graphics capability. Press any key to clear the graph, then select Quit.



Looking at figure 2, you can see that the lines for order costs and carrying costs cross just below 0.6 (meaning 600) on the horizontal axis. This tells you that the correct reorder quantity is whatever convenient amount falls between 500 and 600. If Groucho Marx noses come in lots of 25, for example, you should order 575 at a time.

The graphical approach helps you determine something besides the optimal reorder quantity. The shape of the *Total Cost* line indicates how sensitive an item is to variations in reorder quantity. Suppose your per-order cost was $20 instead of $10. Change the value in cell C4 to 20, press the CALC key, and redraw the graph by selecting /Graph View (in *Symphony*, MENU Graph Preview). The graph now indicates that the proper reorder quantity is 800. Note that the *Total Cost* curve is shallower and flatter in the area around its low point. With the higher ordering cost, you have more leeway in deciding how many to order.

You can use this worksheet, just as it is, to find the reorder quantity and sensitivity for any item you stock. Just enter the name, per-item cost, and yearly usage of the item in range C1..C3, enter your firm's per-order cost and the appropriate carrying-cost percentage in cells C4 and C5, and press the CALC key. The formulas in range A9..A63 will continue to return values from zero to just above the yearly usage. The values in range B9..D59 will adjust accordingly. When you redraw the graph, it will show the new results of the formulas, the X and Y axes will be properly scaled, and the second line of the title will be the same as the label you enter in cell C1.

THE FORMULA APPROACH

Figure 3 shows a worksheet that calculates the optimal reorder quantity. It has the advantage of being able to show several inventory items at a time. Notice that the first item, Groucho noses, has a reorder quantity of 566. This bears up the first result we got with the graphical approach. The worksheet also shows the reorder point, the inventory level at which you should reorder, given the items' lead times, or the amount of time required to get them from your suppliers or from production. For example, it takes eight business days to order and receive the Groucho noses. You should therefore reorder when you have eight day's worth, or 49 pieces, in stock.

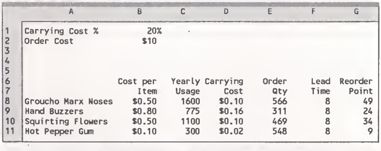
What happens if there are unexpected delays in receiving a shipment? As a wise inventory manager, you may designate some of the firm's stock as "safety" stock by subtracting the amount you want to keep in reserve from the on-hand amount you use for reordering purposes. You might designate 50 Groucho noses in your stockroom as safety stock. Thus, you would order more Groucho noses when you had 99 pieces, rather than 49, in stock. If your stock is depleted to "zero" and you use some additional stock, you're dipping into reserves.

The worksheet computes optimal reorder amounts by using the standard EOQ formula:

$$\text{EOQ} = \sqrt{\frac{2 \times S \times O}{C}}$$

In the formula, S stands for a year's supply, O stands for the cost of making an order, and C stands for the carrying cost for one unit for one year.

To use the worksheet, you enter the carrying-cost percentage and order cost in cells B1 and B2. Then enter the



```
            A                  B         C        D          E        F        G
 1  Carrying Cost %          20%
 2  Order Cost               $10
 3
 4
 5
 6                       Cost per   Yearly Carrying     Order     Lead  Reorder
 7                           Item    Usage     Cost       Qty     Time    Point
 8  Groucho Marx Noses      $0.50     1600    $0.10       566        8       49
 9  Hand Buzzers            $0.80      775    $0.16       311        8       24
10  Squirting Flowers       $0.50     1100    $0.10       469        8       34
11  Hot Pepper Gum          $0.10      300    $0.02       548        8        9
```

FIGURE 3. Column E in this worksheet shows the optimal reorder quantities for several inventory items using the formula approach described in the text. It also computes, in column G, the inventory level at which the items should be reordered, given the lead times entered in column F.

KRISTEN FUNKHOUSER

item names, the per-item costs, and the yearly usage amounts in columns A through C. Formulas in column D compute the per-item carrying cost by multiplying the costs by the carrying-cost percentage in cell B1. Formulas in column E compute the reorder quantities, using the EOQ formula. Enter the lead times for the items in column F. Column G contains formulas that compute the reorder point by dividing yearly usage by 261 (the number of weekdays in a year) and multiplying that amount by the number of lead days. Replace the number 261 with the number of days per year in which your firm can place and receive orders. For example, if your company conducts business on Saturdays, you'd use the number 313.

To create the formula approach worksheet in figure 3, follow the instructions in the "How to" box. Adapting the worksheet for your own firm is simple. Enter your own data in columns A, B, C, and F. Assign a currency format with two decimal places to all the cells in column B in which you enter values. Copy the formulas in columns D, E, and G as far down their columns as necessary. ■

Richard Cranford is assistant editor of features at LOTUS.

HOW TO SET UP THE WORKSHEETS

THE GRAPHICAL APPROACH WORKSHEET

1. Default settings

Recalculation: Manual
1-2-3: /Worksheet Global Recalculation Manual
Symph: MENU Settings Recalculation Method Manual Quit

Format: Currency, 0
1-2-3: /Worksheet Global Format Currency, enter 0
Symph: MENU Settings Format Currency, enter 0, select Quit

2. Cell formats

Format	**Range**
Currency, 2	C2
General	C3
Percent 0 (*Symph*: % 0)	C5
General	A9..A10

For example, to set the format for cell C2, select

1-2-3: /Range Format Currency, press Return to accept two decimal places, indicate cell C2
Symph: MENU Format Currency, press Return to accept two decimal places, indicate cell C2

3. Labels

Enter the labels shown in figure 1 in range A1..A5, cell C1, and range A7..D8. Right-align the labels in rows 7 and 8: Select /Range Label Right (*Symph*: MENU Range Label-Alignment Right), indicate range A7..D8. Enter the labels in range E59..G59 of figure 1. Note: These labels will overlap each other on your screen—columns in figure 1 are widened to show the labels.

4. Values

Enter values shown in range C2..C5 of figure 1. Remember to type % after the value in cell C5. Enter 0 in cell A9.

5. Range names

Name	**Range**
cost	C2
usage	C3
ordercost	C4
carry	C5

For example, to assign the range name *cost* to cell C2, press slash (*Symph*: MENU), select Range Name Create, enter *cost*, indicate cell C2.

6. Formulas

Cell	**Formula**
A10	+A9+$usage/50

Copy cell A10 to range A11..A63.

Cell	**Formula**
B9	+A9/2*$cost*$carry

Copy cell B9 to range B10..B59.

Cell	**Formula**
C13	+$usage/A13*$ordercost
D13	+B13+C13

Copy range C13..D13 to range C14..C59.

THE FORMULA APPROACH WORKSHEET

1. Default settings

Recalculation: Manual
1-2-3: /Worksheet Global Recalculation Manual
Symph: MENU Settings Recalculation Method Manual Quit

Format: Fixed, 0
1-2-3: /Worksheet Global Format Fixed, enter 0
Symph: MENU Settings Format Fixed, enter 0, select Quit

2. Individual column widths

Column	**Width**
A	19

Position the cell pointer in column A, select

1-2-3: /Worksheet Column Set-Width, enter 19
Symph: MENU Width Set, enter 19

3. Cell formats

Format	**Range**
Percent 0 (*Symph*: % 0)	B1
Currency, 0	B2
Currency, 2	B8..B11
Currency, 2	D8

For example, to set the format for cell B1, select

1-2-3: /Range Format Percent, enter 0, indicate cell B1
Symph: MENU Format %, enter 0, indicate cell B1

4. Labels

Enter the labels shown in column A and in rows 6 and 7 of figure 3. Right-align the labels in rows 6 and 7: Select /Range Label Right (*Symph*: MENU Range Label-Alignment Right), indicate range B6..G7.

5. Values

Enter the values shown in figure 3 in ranges B1..B2, B8..C11, and F8..F11. Type % after the value in cell B1.

6. Range names

Name	**Range**
carry	B1
ordercost	B2

For example, to assign the range name *carry* to cell B1, press slash (*Symph*: MENU), select Range Name Create, enter *carry*, indicate cell B1.

7. Enter and copy formulas

Cell	**Formula**
D8	+BB*$carry
E8	@SQRT(2*CB*$ordercost/D8)

Copy range D8..E8 to range D9..D11.

Cell	**Formula**
G8	+C8/261*FB

Copy cell G8 to range G9..G11.

BY STEPHEN L. NELSON

BUILD A RETIREMENT NEST EGG

What will your income be when you're 65?

Each year, you get closer to those golden years when you hope to be blessed with both health and wealth. While a spreadsheet can't guarantee good health, it can help you plan and save for your retirement.

This article describes a model that calculates the financial results of your personal retirement program. The model has two parts: building the nest egg and spending the nest egg. Based on your retirement age, the number of years of retirement, and estimates about inflation, you derive a best guess of how much money you'll have available to supplement programs such as your company's retirement plan and, if it still exists, social security.

Before looking at the model, consider three factors that affect your retirement savings: the power of compound interest, the benefit of deferred income tax, and the often ravaging effect of inflation.

The first factor, compound interest, means earning interest on interest. Say you stash away $1,000 in an account earning 10%. During the first year, your investment earns $100 in interest. Leave the $100 in the account, and during the second year, you earn $110 on the $1,100. The extra $10 is interest on the prior year's interest.

Although the extra $10 may not seem like much, it adds up. Leave each year's interest in the account, and after 10 years, the original $1,000 grows to $2,593.74, more than double the initial investment.

The second factor, deferred income tax, is tax payments that you postpone. These postponed payments give retirement savings plans such as individual retirement accounts (IRAs), 401(k)s, and Keoghs their punch. Assuming that you qualify, you reduce your current income tax and postpone the tax on interest earnings.

For example, suppose you are in the 28% tax bracket and want to invest $1,000 in an IRA that earns 10% annually. The power of deferred tax helps you in two ways. First, because you save $280 on your current tax liability, you should be able to put away $1,280, not $1,000, in the IRA. Second, because you don't pay income tax on the interest earned on the IRA, you will compound interest at the full rate of 10%, instead of an effective 7.2% rate (10%*(1−28%)) on a taxable investment.

Combining the power of compound interest with deferred taxes, you might think you'd be a millionaire by age 65. And that's exactly what those who advertise "How to Make (Almost) a Million" want you to believe. These ads declare that if you invest $2,000 a year in an IRA and earn 12% annual interest, you'll accrue about $900,000 in 35 years.

The offer sounds too good to be true, and it is. While the advertisement's mathematics are correct, you see only half the picture, since the calculations fail to consider inflation. Even if you earned 12% annually, inflation might be screaming along at rates that could easily be 8% to 10%. In fact, earning an annual return that beats inflation by 3% to 4% is no mean feat. What if, for example, inflation averaged 8% for 35 years? Well, adjusting for inflation, minimum wage in the year 2023 would be about $100,000 a year; gas, $15 a gallon; and two tickets to *Rocky XXXIX*, close to $200.

So any model that forecasts retirement savings must take into consideration these three factors. The model presented here does just that. To build it, follow the instructions in the setup box on page 69.

BUILDING THE NEST EGG

The first part of the model relies on three basic data items: the number of years until your retirement, your current marginal tax rate, and an annual payment inflator. In addition, you specify the initial balances, first-year savings amount, and annual returns for your retirement savings. Formulas calculate the after-tax return and future balance of each investment.

The marginal tax rate is used in formulas that calculate the after-tax return. If you're unsure of your tax rate, consult your financial advisor.

To keep your savings growing along with inflation, you must specify an annual payment inflator. This is the percent by which you will increase your annual retirement contributions. Because annual inflation is generally around 5%, plan to increase your payments to retirement savings investments by at least that percent.

Retirement savings break down into three categories: taxable, tax-deferred, and nontaxable. Taxable savings are amounts for which you must pay annual income tax on interest earned. For the annual return estimate, specify 9%, roughly the historical return delivered by the stock market, or use the annual return on long-term bonds listed in *The Wall Street Journal*. The worksheet calculates the after-tax return on taxable savings. The tax-deferred category operates similarly, except that interest earnings on retirement savings will compound tax-free. Therefore, your actual annual return is the same as the after-tax return. The same is true for your nontaxable savings.

You might think that you should use the @FV function to perform the future balance calculation. However, that function calculates the future value of a stream of even payments. It isn't applicable here because you may have already stashed away some retirement money and you may not make even payments. Therefore, use the following formula to calculate the future value of any current savings:

$$(\text{Initial Balance}) \times (1+\text{After-Tax Return})^{\text{Years to Retirement}}$$

To calculate the future value of the annual amounts you will save, use formula 1 below.

By combining the two formulas, you calculate the total estimated value of your current and future investments when you retire. Given the hypothetical data in the model, you'll have saved $594,300 by retirement.

This formula assumes that the annual payment inflator is ***not*** equal to the after-tax return. If your annual payment inflator equals the after-tax return, use formula 2 to calculate the future value of your retirement savings.

For example, if this were the case for your tax-deferred savings, the formula in cell F14 would be:

$$\frac{\text{Savings First Year}}{(\text{After-Tax Return})-(\text{Annual Payment Inflator})} \times \left[1-\left(\frac{1+\text{Annual Payment Inflator}}{1+\text{After-Tax Return}}\right)^{\text{Years to Retirement}}\right] \times$$
$$(1+\text{After-Tax Return})^{\text{Years to Retirement}} + (\text{Initial Balance}) \times (1+\text{After-Tax Return})^{\text{Years to Retirement}}$$

FORMULA 1

$$\left(\frac{(\text{Years to Retirement} \times \text{Savings First Year})}{(1+\text{After-Tax Return})}\right) \times (1+\text{After Tax Return})^{\text{Years to Retirement}} + (\text{Initial Balance}) \times (1+\text{After-Tax Return})^{\text{Years to Retirement}}$$

FORMULA 2

IRA M. KORMAN

EARNING AN ANNUAL RETURN THAT BEATS INFLATION BY 3% TO 4% IS NO MEAN FEAT.

```
+($B$5)*(C14)/(1+E14)*(1+E14)^($B$5)+
  (B14)*(1+E14)^($B$5)
```

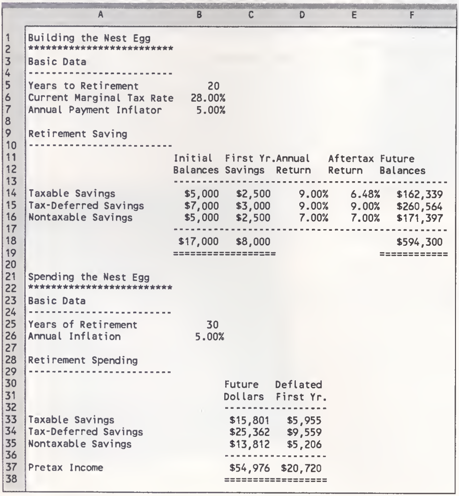
If you're interested in the derivation of these formulas, look at a good college finance textbook, such as *Introduction to Financial Management*, by Charles W. Haley and Lawrence D. Schall (McGraw-Hill, 1988). The book describes the algebra necessary to transform the present-value formula to allow for growth in the annual savings amount.

SPENDING YOUR NEST EGG

The second portion of the model relies upon two assumptions that are quite difficult to make: the number of years you'll spend in retirement and an annual inflation rate. The years-of-retirement estimate is essentially a personal mortality forecast. It's true that over large populations, actuarial tables can accurately forecast average mortality rates. But here, you're not applying a statistical history to a large population. You're talking about your own death, so your estimate will be imprecise.

Even harder to forecast is the effect that inflation will have on the value of the dollars you're saving. Many personal financial planners use rates of 4% or 5%—roughly the current inflation rate. But who knows what the future holds. We may experience deflation, which has occurred before with results more devastating than those of inflation. Consequently, the best tactic is to experiment with the assumptions to test the relative effect of various savings strategies and economic scenarios.

This hypothetical case assumes 30 years of retirement and annual inflation of 5%. Given these assumptions, the



```
                  A                   B        C         D         E          F
1   Building the Nest Egg
2   *************************
3   Basic Data
4   -------------------------
5   Years to Retirement             20
6   Current Marginal Tax Rate   28.00%
7   Annual Payment Inflator      5.00%
8
9   Retirement Saving
10  -------------------------
11                            Initial  First Yr.Annual    Aftertax Future
12                            Balances Savings  Return    Return   Balances
13                            ---------------------------------------------
14  Taxable Savings             $5,000   $2,500     9.00%     6.48%  $162,339
15  Tax-Deferred Savings        $7,000   $3,000     9.00%     9.00%  $260,564
16  Nontaxable Savings          $5,000   $2,500     7.00%     7.00%  $171,397
17                            ---------------------------------------------
18                            $17,000   $8,000                       $594,300
19                            =================                   ===========
20
21  Spending the Nest Egg
22  *************************
23  Basic Data
24  -------------------------
25  Years of Retirement             30
26  Annual Inflation             5.00%
27
28  Retirement Spending
29  -------------------------
30                                     Future   Deflated
31                                     Dollars  First Yr.
32                                     -----------------
33  Taxable Savings                    $15,801   $5,955
34  Tax-Deferred Savings               $25,362   $9,559
35  Nontaxable Savings                 $13,812   $5,206
36                                     -----------------
37  Pretax Income                      $54,976  $20,720
38                                     =================
```

The retirement planning worksheet has two sections: Building the Nest Egg and Spending the Nest Egg. For the Building the Nest Egg section, you provide three basic data items: the number of years until you retire, your marginal tax rate, and the amount by which you plan to increase your payments yearly to keep up with inflation. Then you enter initial balances, first-year savings amount, and annual return. Formulas calculate the after-tax return and future balances. This portion of the model lets you see how you can "grow" your retirement savings along with inflation.

The Spending the Nest Egg section relies on two basic data assumptions: the number of years you'll be retired and an annual inflation rate. The *Future Dollars* column calculates the annual withdrawals that you can make from each of your retirement investments. You might think that $55,000 a year would nicely supplement other retirement income; however, you must also consider the actual spending power of those dollars. Deflated, the $55,000 is really worth $20,000—not quite the pot of gold you imagined.

HOW TO SET UP THE WORKSHEET

1. Individual column widths

A	25
F	12

For example, to set the width of column A, place the cell pointer in column A and select

1-2-3: /Worksheet Column Set-Width, enter 25
Symph: MENU Width Set, enter 25

2. Labels
Enter the labels shown in the figure. To create rows of dashes, enter \– or \= and copy as necessary. To create the rows of asterisks, enter *.

3. Cell formats

Format	**Range**
Percent 2	B6..B7
(*Symph:* % 2)	D14..E16
	B26
Currency 0	B14..C18
	F14..F18
	C33..D37

For example, to set the format for range B6..B7, select

1-2-3: /Range Format Percent 2, indicate range
Symph: MENU Format % 2, indicate range

4. Values
Enter all values shown in ranges B5..B7, B14..D16, and B25..B26.

5. Enter and copy formulas

Cell	**Formula**
E14	`+D14*(1-B6)`
E15	`+D15`
E16	`+D16`
F14	`+C14/(E14-$B$7)*(1-((1+$B$7)/(1+E14))^($B$5))*(1+E14)^($B$5)+(B14*(1+E14)^($B$5))`

Copy cell F14 to range F15..F16.

B18 `@SUM(B14..B16)`

Copy cell B18 to cells C18 and F18.

C33 `@PMT($F14,$D14,$B$25)`

Copy cell C33 to range C34..C35.

D33 `+$C33/(1+$B$26)^($B$5)`

Copy cell D33 to range D34..D35.

C37 `@SUM(C33..C35)`

Copy cell C37 to cell D37.

model calculates that you can annually draw $15,801 from your taxable savings nest egg, $25,362 from your tax-deferred-savings nest egg, and $13,812 from your nontaxable-savings nest egg for each year of retirement. To calculate the annual withdrawal amount from each savings category, the worksheet uses the @PMT function, with the principal amount set as the future balance of the nest egg, the interest rate set as the annual return, and the number of payments set as the years of retirement. With these as the annual withdrawals, you reduce your nest egg to zero by the end of 30 years.

The *Deflated First Yr.* column estimates the current dollar value of the withdrawals you're forecasting from the nest egg investments. The formula deflates the future dollar amounts, using the denominator (1 + Annual Inflation)^(Years to Retirement). If you assume annual interest rates or returns that include an allowance for inflation, you must also recognize that everything will be more expensive. You already saw that over the 20 years you accumulate quite a bundle, almost $600,000, which translates into annual payments of about $55,000 for each retirement year. However, this is an inflated estimate of the true value of the money. Taking deflation into consideration, the $55,000 gives you the spending power of only $20,000.

IS THERE ANY HOPE?

One problem with this hypothetical case is that saving for retirement started too late (20 years before retirement) to get a big bang from compounded interest. As with most investments, the earlier you start saving, the brighter your financial future will be.

Given the economic strength of compound interest and deferred income tax, consider putting all your retirement savings into tax-deferred savings investments such as 401(k)s, IRAs, and Keoghs. Suppose you put the total initial balance of $17,000 into tax-deferred investments and invest $8,000 annually in tax-deferred plans. Doing so increases the total future balance, shown in cell F18, by almost $100,000 and your annual retirement spending by about 21%.

The model assumes that you want to set an annual payment inflator that is at least equal to inflation. But what if you want to "grow" your savings faster than inflation? If you set 10% as the payment inflator, for example, at some point your savings rate will probably grow faster than your salary. This isn't necessarily a problem. Just be aware that over time you'll be putting larger and larger amounts of your income into savings.

The best way to use this model is to test the relative merits of different retirement-savings strategies. Don't use it to construct a rigid savings plan that you religiously follow until you retire. After all, you're covering a forecasting horizon during which the economy will change quite a bit. Remember, too, that many indefinite assumptions are built into the model: annual interest rates over the next several decades, inflation estimates, income tax rate, your own death, and indirectly, your earning power.

The whole process of planning retirement savings is difficult and challenging. Accordingly, you may want to invest some additional time and money reviewing any plan you've constructed with a tax advisor, investment counselor, or financial planner. But bring along your model. It should make planning and saving for your future easier and your golden years a little more golden. ■

Stephen L. Nelson, CPA, is a consultant in Seattle, Wash., and author of Using DacEasy Accounting *(Que Corp.).*

Q&A

ANSWERS TO YOUR QUESTIONS ABOUT LOTUS PRODUCTS

SYMPHONY

AUTOLOAD ADD-INS

Q. Can I automatically attach my *Symphony* Macro Library Manager and Spelling Checker?

Ryan F. Dogherty
Sellersville, Pa.

A. Yes, *Symphony* can automatically attach your add-in applications. If you use a two-disk system, it's easier to load add-ins yourself after loading *Symphony*. On a hard-disk system, press SERVICES, select Configuration Other Application Set, and select a number. Select number 1 if this is the first application to autoload. Highlight the application that should attach automatically, press Return, and select No. If you select Yes, *Symphony* will both attach and invoke the application each time you start up. Select Set if you want to set a second add-in; otherwise, select Quit Update Quit.

1-2-3

WORKSHEET FILE REVISION IS OUT-OF-DATE

Q. I use *1-2-3* Release 2. The error message *Worksheet file revision is out-of-date* appears when I try to retrieve several of my files. What does the message mean, and can I retrieve the worksheets?

Theresa Li
Chai Wan
Hong Kong

A. This error message can appear when the file you try to retrieve is damaged. If the file isn't password-protected, you may be able to recover it with a file-recovery program such as *The Norton Utilities* or *Rescue*. You probably will not be able to recover a password-protected file, however.

If you try to combine a named range into your worksheet from a password-protected file but get the error message *Named range not found in worksheet file* and you save the current worksheet, the resulting file will be damaged. At this point you'll receive the error message *Worksheet file is out-of-date*, and you won't be able to recover it. This is a bug in *1-2-3* Release 2 that was fixed in Release 2.01.

MATRIX OPERATIONS DON'T RECALCULATE

Q. I have a worksheet in which many calculations rely on values generated by the Data Matrix command. Unfortunately, *1-2-3* doesn't recalculate the matrix operations when I recalculate the worksheet. This means that each time I change a value involved in the matrix calculations, I must reissue the Data Matrix command and then recalculate the entire worksheet. Am I overlooking something?

D. J. Nocturne
Union Carbide Corp.
Danbury, Conn.

A. *1-2-3* Release 2/2.01 doesn't recalculate a matrix generated by the Data Matrix Multiply command when you recalculate the worksheet. If using the menus to perform the matrix operations drives you crazy, try writing a macro.

The simplest macro you can write will repeat the Matrix Multiplication command, using whatever matrices you last multiplied. To use the macro, perform the matrix multiplication once manually. Then enter the label */DMM~~~* into an out-of-the-way cell, and assign the range name *\m* to that cell. Whenever you wish to remultiply the matrices that you multiplied manually, simply hold down the MACRO key (Alt on most computers) and press M.

To recalculate a new matrix, use the following macro:

```
/DMM{?}~{?}~{?}~
```

1-2-3 will pause so that you can enter new ranges to multiply, as well as a new Output range.

USING GLOBAL DEFAULTS

Q. Whenever I set global default settings, they are reset automatically when I leave *1-2-3*. For example, I select /Worksheet Global Format, select the comma format, and press Return to accept two decimal places. Then I select /Worksheet Global Default Update. When I exit from *1-2-3* and reenter the program later, the blank worksheet cells once again use the General format as the default. There is an active 123.CNF file in my *1-2-3* directory. What am I doing wrong?

Jacob G. Bender
McAdoo, Penn.

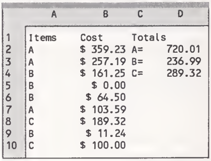
A. The Worksheet Global Default command lets you set specific default settings such as printer configuration, default data directory, international numeric, currency, date, and time format, help access method, and clock display. Select /Worksheet Global Default Status to view the current status of the options available to you on the Default menu. The Update selection preserves only the options you've chosen from the Default menu.

The options you select from the Worksheet Global menu (Format, Label-Prefix, Column-Width, Recalculation, Protection, and, in Release 2/2.01, Zero) are individual to every spreadsheet you create and are not part of the 123.CNF file. If you require preestablished global settings, you should start with a blank spreadsheet, select the required settings, and save the file with a name such as TEMPLATE. With this method, rather than set the Global settings each time, you would issue the File Retrieve command. If you wish the file to be automatically retrieved when you start *1-2-3*, assign the name AUTO123 to the formatted file. Make sure you save each new file you create under a name different from TEMPLATE or AUTO123.

1-2-3/SYMPHONY

ADDING LIKE ITEMS

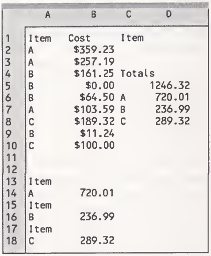
Q. I need a way to add up all A items, B items, and C items, and place the results in column D. I'd like the totals to be updated as I add items to the list. How can I do this?



	A	B	C	D
1	Items	Cost	Totals	
2	A	$ 359.23	A=	720.01
3	A	$ 257.19	B=	236.99
4	B	$ 161.25	C=	289.32
5	B	$ 0.00		
6	B	$ 64.50		
7	A	$ 103.59		
8	C	$ 189.32		
9	B	$ 11.24		
10	C	$ 100.00		

Lisa Hammersley
Wallingford, Conn

A. Here are two methods for you to try. Refer to the following figure for both methods.



	A	B	C	D
1	Item	Cost	Item	
2	A	$359.23		
3	A	$257.19		
4	B	$161.25	Totals	
5	B	$0.00		1246.32
6	B	$64.50	A	720.01
7	A	$103.59	B	236.99
8	C	$189.32	C	289.32
9	B	$11.24		
10	C	$100.00		
11				
12				
13	Item			
14	A	720.01		
15	Item			
16	B	236.99		
17	Item			
18	C	289.32		

The @DSUM Method: Create a Criterion range and an @DSUM formula for each of the A, B, and C items. For example, the Criterion range for item A is range A13..A14. Cell B14 contains the formula @DSUM(A1..B10,1,A13..A14). This formula sums the cost of all A items in range A2..B10. Cell B16 contains the formula @DSUM(A1..B10,1,A15..A16), and cell B18 contains the formula @DSUM (A1..B10,1,A17..A18).

Select /Worksheet Global Recalculation Automatic (in *Symphony*, MENU Settings Recalculation Method Automatic) so that these formulas will be automatically recalculated each time you change the existing list. Update the first argument in each formula to include the new row if you add items to the list.

The Data Table (in *Symphony*, What-If Table) Method: List in a column the item codes you want to sum. In our example, these codes appear in cells C6, C7, and C8. Enter the formula @DSUM(A1..B10, 1,C1..C2) in cell D5. To calculate the table, select /Data Table 1 (in *Symphony*, MENU Range What-If 1-Way) and specify range C5..D8 as the Table range and cell C2 as Input cell 1.

If you make changes to the existing list in *1-2-3*, recalculate the table by pressing the TABLE key. In *Symphony* reissue the Range What-If command after changing the data. If you add items to the list, update the first argument in the @DSUM formula in cell D5 to include the new rows.

SUMMING A COLUMN BASED ON A CRITERION

Q. I have a worksheet that contains two columns of numbers. What formula can I use to sum all numbers in column B whose corresponding cells in column A contain the value 1.

Jeff Graves
Marshfield, Wis.

A. The @DSUM function can perform the calculation you desire. The syntax of the @DSUM function is @DSUM(*input, offset,criterion*). The *input* (in *Symphony, database*) argument must refer to a range that contains a database. All that distinguishes a database from two adjacent columns of numbers is the presence of labels heading each column. You can make your columns of numbers serve as an Input (in *Symphony*, Database) range by placing database field names in the cells above the values in columns A and B as shown in the illustration.

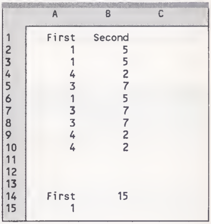
The *offset* argument of the function identifies which column within the Input (in *Symphony*, Database) range contains the values you wish to sum. Column A is offset zero columns from the left of the range. Column B is offset one column from the left. The *offset* argument in your @DSUM function will be 1.

The *criterion* argument must refer to a range of at least two cells in a single column. The upper cell will contain a copy of the field name for column A, and the lower cell will contain the number 1, as you see in range A14..A15 of the figure. This Criterion range means "find each entry in *First* whose value is 1."

Having prepared the Input (in *Symphony*, Database) and Criterion ranges and knowing the value of the *offset* argument, enter the following formula in cell B14 to perform the addition you're looking for:

@DSUM(A1..B10,1,A14..A15)

You can use this technique in all releases of *1-2-3* and *Symphony*.



	A	B	C
1	First	Second	
2	1	5	
3	1	5	
4	4	2	
5	3	7	
6	1	5	
7	3	7	
8	3	7	
9	4	2	
10	4	2	
11			
12			
13			
14	First	15	
15	1		

ELIMINATING MARGINS

Q. How can I eliminate the blank lines *1-2-3* leaves at the top and bottom of every printed page? I've tried setting the top and bottom margins to zero, but this doesn't help.

Donald H. Fiedler
Greenville, S.C.

A. To suppress top and bottom margins, select /Print Printer Options Other Unformatted (in *Symphony*, SERVICES Print Settings Page Breaks No). These commands also suppress page breaks, headers, and footers.

PRINTING ONLY THE COLUMNS YOU WANT

Q. I maintain a roster for our golf team. When I print reports, I don't always want to include all the information on the spreadsheet. In the past, I've printed several consecutive columns, rolled the paper back, then printed the remaining necessary columns. Is it possible to skip columns when printing?

R E Coffman
Green Valley, Ariz

A. Print selected columns by hiding columns you don't wish to print. In *1-2-3* select /Worksheet Column Hide (in *Symphony*, MENU Width Hide) and indicate the columns you wish to exclude from the printout. The hidden columns won't appear in the worksheet even when you indicate a Print range.

To display hidden columns after you've printed a report, select /Worksheet Column Display (in *Symphony*, MENU Width Display). All hidden columns will appear on the screen with an asterisk next to their column letters. Select any columns you wish to display. You cannot hide columns in *1-2-3* Release 1A or in *Symphony* Release 1/1.01.

Q&A REVISITED

ERR WITH @TERM

The answer you provided Ruth Jenkins [April], regarding the term necessary to repay a loan, wasn't logical. You can't pay off a $100,000 debt that earns $10,000 a year interest if you pay only $2,000 per year. That's why the @TERM function returns ERR.

Ms. Jenkins's formula gives a valid answer if the payment per period is greater than interest earned. For example, if the $2,000 is really a monthly payment, the interest per payment period is 10%/12 (10% a year divided by 12 months). The correct formula is @TERM(2000,0.1/12, −100000), which returns −64.9487, or 65 months.

E Richard Cohen
Rockwell International Science Center
Thousand Oaks, Calif

CONVENTIONAL MEMORY LIMIT OF 640K EXCEEDED

I'd like to add to your answer to William E. Cummings [April] regarding memory that exceeds 640K on an IBM PS/2 computer. I was faced with the same situation and was frustrated at not being able to use all the available memory for large applications in *Symphony*.

I found a solution in a product called *SoftBytes* (from Vericomp, San Diego, Calif., 619-277-0400). The product uses the extended memory of the PS/2 to simulate the presence of the Lotus/Intel/Microsoft Expanded-Memory Specification. It provides access to the computer's additional 384K of memory. *SoftBytes* also lets you use hard-disk space as expanded memory, but at much lower speeds.

Robert H Read
Wisconsin Dept of Natural Resources
Madison, Wis

FORMULAS FOR CREATING DELIMITED ASCII FILES

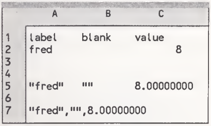
Q. In the October issue you supplied a formula to create a delimited ASCII file. The formula was exactly what I needed. I was disappointed, however, to learn that the formula resulted in ERR instead of an ASCII-delimited format when any cell located in the row was empty.

Is there a way to make the formula smarter, that is, to include a check for empty cells? It is tedious to place spaces in every blank field when you are using several fields.

Jim Gardner
Input
Mountain View, Calif

A. The formula we supplied handles records that contain labels and values. You need to modify the formula to handle fields that contain blanks.

The ASCII-delimited format requires that text entries be enclosed in quotation marks and that all pieces of data be separated by commas. To see how our solution works, enter the data in range A1..C2 as shown in the following illustration:



```
      A          B          C
1  label      blank      value
2  fred                      8
3
4
5  "fred"     ""         8.00000000
6
7  "fred","",8.00000000
```

Enter the following formula in cell A5:

@IF(@N(!A2),@STRING(A2,8),“”
“”&@S(!A2)&“”“”)

Next, copy cell A5 to range B5..C5.

The formula's @IF function evaluates the expression @N(!A2), which returns zero when cell A2 contains a label or the value 0. If cell A2 contains a nonzero value, @N(!A2) returns the value.

When @N(!A2) returns a nonzero value, the @IF formula returns a string representation of that value, padded with trailing zeros to preserve any decimal places the value might have. Most applications disregard the trailing zeros when they read such values from an ASCII file.

When @N(!A2) returns zero, the @IF formula returns the result of the expression “”“”&@S(!A2)&“”“”. The @S function in this expression returns a null string (a string that contains no characters) when cell A2 is blank or contains a zero. When cell A2 contains a label, @S(!A2) returns the label. In any case, the expression encloses the result of the @S function in quotation marks. If cell A2 contains the label *Sales*, the expression returns *"Sales"*. If cell A2 is blank or contains a zero, the expression returns paired quotation marks (“”), which preserve a space in the comma-delimited file to represent a field that does not have an entry.

Once you've entered and copied the formula, use a second formula to tie the comma-delimited entries into one cell. Enter the following formula into cell A7:

+A5&“,”&B5&“,”&C5

Now print the column that contains the desired information to a file by using the Print Printer File command (in *Symphony*, SERVICES Print Settings Destination File). One caveat: Values of 0 will be converted to null strings (“”).

DISPLAY OF RANGE NAMES

In the November issue, Fred Kracker suggested using an asterisk as the first character in a file name to ensure that the file appear first in an alphabetical listing. You warned against using arithmetic operators in file names, but failed to point out the serious danger involved in using an asterisk.

DOS recognizes the asterisk as a wildcard character. When found at the end of a file specification, the asterisk indicates that DOS should perform the pending command on all files whose first characters match the characters preceding the asterisk. Using an asterisk as part of a file name can produce disastrous results.

For example, if you name a file *SAMPLE.WK1 and later decide to delete it, you might want to use the DOS DELETE command. Unfortunately, DOS interprets the command DEL *SAMPLE.WK1 to mean “delete all files with the .WK1 file extension.”

Both the asterisk and the question mark are DOS wild-card characters. You should never use them as part of a file name.

Julio Flores
Garden City, N.J.

DISK FULL ERROR MESSAGE WITH SPACE AVAILABLE

Q. In the August Q&A column, W. A. Followell reported receiving a *Disk full* error message after the computer had taken a long time trying to save a file even though the disk had enough space to store the worksheet.

I recently had a similar problem while saving a small file of 6 columns by 15 rows. Eventually, I realized what had happened. After entering one row of data, I had decided to be efficient and to format the entire spreadsheet. Without thinking, I selected /Range Format Currency (in *Symphony*, MENU Format Currency) and entered 0. I twiddled with the arrow keys for a moment, and when I glanced at the screen, I found that I'd highlighted range A1..F8192. I decided to press Return anyway, and after waiting for the range to format, I finished entering my data.

Then I saved my file. I discovered, however, that it wasn't a 6-by-15-cell spreadsheet. Rather, it was an "efficiently" constructed 49,152-cell spreadsheet. By formatting all those cells, I had "used" them. The file required over 433K of disk space (more than a 360K disk can hold), and the computer, indeed, ran a long time as it saved the file to my hard disk.

So don't format more cells in your spreadsheet than you need. Formatted cells use up memory whether or not they contain data.

G. Spencer Lieske
Baltimore County Public Schools
Towson, Md.

A. If you have a file that takes an unusually long time to recalculate or to save, check to see exactly how large the file is. Press the End key and then the Home key, and the cursor will jump to the end of the active area of the sheet. If there are many blank columns or rows between the cell pointer and the nearest data, you may have a problem. Select /Range Format Reset (in *Symphony*, MENU Format Reset), and designate the blank or unused portion of your spreadsheet as the range to reset. Next save the file and retrieve the saved version. Once again press End-Home. You will find a difference in the size of the spreadsheet.

You can format the entire worksheet before you enter data. Select /Worksheet Global Format (in *Symphony*, MENU Settings Format), and choose the format you wish to use in every cell. Blank or unused cells will not take up memory, but they will display your selected format when you enter values.

AVOIDING ERR IN @SUM

Q. In the October Q&A column, Lynne Favoritte asked a question regarding ERRs that result from an @SUM function. She uses the @IF function to suppress zeros. You suggested that she use the @DSUM function to solve her problem. This works, but Lynne's initial goal was to suppress zeros. Wouldn't she find it easier simply to activate zero suppression?

Ken Erickson
St Helens, Oreg.

A. She might find it easier. To activate zero suppression in *1-2-3* Release 2/2.01, select /Worksheet Global Zero Yes (in *Symphony* Release 2.0 select MENU Settings Zero Yes Quit), and no zero values will appear in the worksheet. Zero suppression isn't preserved when you save the worksheet, so you'll need to reactivate it if you wish to eliminate zeros the next time you retrieve the worksheet. *1-2-3* Release 1A and *Symphony* Releases 1, 1.1, and 1.2 lack the zero-suppression feature.

HARDWARE

PRINTING HIGH-DENSITY GRAPHS ON THE DEC LA50

Q. I have a problem printing a graph on the DEC LA50, using the high-density driver I selected in the PrintGraph program. I can print by selecting low density; however, when I try to print a graph in high density, the graph prints double-spaced rather than darker. What am I doing wrong?

Julie Tappero
Seattle, Wash.

A. To use the driver for high-density mode (double-density mode in *1-2-3* Release 1A, DEC port), you must change your printer's DIP-switch setting. Switch Bank – 1, Switch Number – 5 should be closed. The switches are in front of the printhead. Also, the Graphics Aspect Ratio switch must be in the closed position.

COLOR PRINTING WITH AN EPSON EX-1000

Q. I use an Epson EX-1000 printer with the Epson EX-1000 Color Option Kit. I produce financial statements and want to print some of the figures in a color other than black. For example, I would like to print all negative figures in red. How can I do this?

James G. Anderson
Massapequa Park, N.Y.

A. You cannot print some of the spreadsheet numbers in red and the rest in black because neither *1-2-3* nor *Symphony* has a driver written specifically to do this. Furthermore, there isn't a driver written specifically for the Epson EX-1000 printer. Use the Epson FX and RX drivers for text printing and the Epson JX-80 series driver for graphics printing. With the Color Option Kit, the printer is capable of printing full-color graphs. Unfortunately, because the Epson FX and RX printers are not color printers, the text printer driver doesn't print text in color.

WHICH MICE WITH 1-2-3?

Q. I'd like to purchase a mouse to use with *1-2-3*. Which ones will work?

Janet Fasnacht
U.S. Navy
Mechanicsburg, Pa.

A. The following mice have been tested by Lotus Development Corp. and are listed as Lotus-certified compatibles: The Maynard Mouse works with *1-2-3* Release 2/2.01 and *Symphony* Release 1.1/1.2; the Mouse Systems PC Mouse and PC Mouse Bus Plus work with *1-2-3* Release 2.01 and *Symphony* Release 1.2. ■

This material is prepared by Elizabeth A. Stahl and the Technical Editors, with the help of the Lotus Product Support staff.

WRITE US

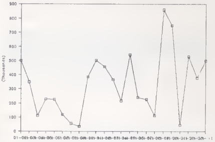
Do you have a question? We can't answer every letter, but if yours is selected, we'll publish it along with an answer or a request to other readers for advice. We'll pay $25 for each letter we publish. Send your letters, including your address and daytime phone number, to: Q&A, LOTUS *Magazine, P.O. Box 9123, Cambridge, MA 02139–9123.*

READER TIPS ON USING LOTUS PRODUCTS

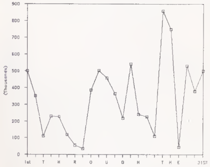
1-2-3/SYMPHONY

FIXING CROWDED X RANGE

I had a problem creating a line graph to represent the sales figures for each working day in March. On the graph I created, the X axis was illegible because the day numbers were crowded together.

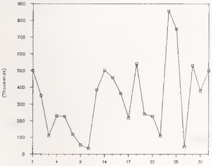


I worked around the problem by using *1st THROUGH THE 31st* as the X-axis labels. I entered the label *1st* in the first cell of the X-axis labels range and the label *31st* in the range's last cell. The remaining characters I entered as labels and spaced across the range. This creates a more legible printed graph. The label is meaningful, and the tick marks along the X axis coincide with the graphed data points. If your data is displayed columnwise, enter the characters going down the column.



Deborah Sgariglia
Dudley, Mass.

To correct the overcrowding of points on the X axis, you can also select /Graph Options Scale Skip (in Symphony, *MENU Graph 2nd-Settings Other Skip) and specify a skip factor of 2 or 3. The program then displays only every second or third point along the X axis. This method has a minor drawback: The label for the last point, for example* 31, *may not always appear if the skip factor does not coincide with that point. However, the last point will appear as a tick mark on the X axis.*



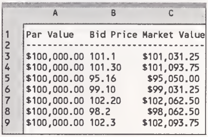
CALCULATING MARKET VALUE

You usually find the market value of some investments, such as bonds, by multiplying the face or par value of the investment by the bid price, which is often given as a percentage. However, a significant problem arises if the bid price includes a decimal, such as in the price 102.2. Decimals in bid prices often represent thirty-seconds of one percent. Therefore, 102.2 does not mean 102.2%; it means 102% plus 2/32 of one percent, or the decimal equivalent 102.0625%.

I solved this problem in *1-2-3* Release 2/2.01 and *Symphony* by writing a single formula. This method requires that you enter bid prices as labels rather than values, thereby maintaining trailing zeros. In the example that follows, this formula resides in cell C3 and is copied to range C4..C9:

```
@IF(@CODE(@RIGHT(B3,2))=46,
  (((@VALUE(B3)-@INT(@VALUE
  (B3)))/320)+(@INT(@VALUE
  (B3))/100))*A3,(((@VALUE
  (B3)-@INT(@VALUE(B3)))/32)
  +@INT(@VALUE(B3)/100))*A3)
```

The @IF formula in cell C3 evaluates the entry in cell B3 and determines whether the second character from the right in a bid price is a period. If so, the formula divides the decimal portion of the bid price by 320, adds the result to the integer portion of the bid price, and multiplies the resulting bid price by the par value in cell A3 to produce the market value. If not, then the formula divides the decimal portion by 32. For bid prices with two decimal places (range B4..B7), you need to change the 2 in the @RIGHT function to 3.



```
         A           B           C

1  Par Value    Bid Price Market Value
2  ------------------------------------
3  $100,000.00 101.1       $101,031.25
4  $100,000.00 101.30      $101,093.75
5  $100,000.00 95.16        $95,050.00
6  $100,000.00 99.10        $99,031.25
7  $100,000.00 102.20      $102,062.50
8  $100,000.00 98.2         $98,062.50
9  $100,000.00 102.3       $102,093.75
```

Donald D. Uyhazi
New Jersey Educational Facilities Authority
Lawrenceville, N.J.

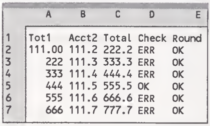
USING @ROUND IN CROSS-CHECKING FORMULA

The way *1-2-3* and *Symphony* store decimal values can cause an @IF cross-checking formula to result in an incorrect answer. You can easily correct the problem, however, by using the @ROUND function.

Suppose you have a lump-sum deposit

that you distribute among several accounts, as shown in columns A and B of the figure. To sum each pair of deposits, enter @SUM(A2..B2) in cell C2 and copy the formula down column C. In cell D2 enter the formula @IF(@SUM(A2..B2) =C2,"OK",@ERR) and copy it down column D. The formula should return the string *OK* because it equates the expression @SUM(A2..B2) with the value in cell C2—a value that results from the same calculation. As you can see from the results, though the sum appears to be correct, the cross-checking formula may evaluate to ERR. ERR shows that the two expressions aren't equivalent. The following formula uses the @ROUND function to solve the problem. Enter it in cell E2 and copy it down column E:

```
@IF(@ROUND(@SUM(A2..B2),1)=
  @ROUND(@SUM(C2),1),"OK",
  @ERR)
```



```
       A      B     C     D     E
1  Tot1   Acct2 Total Check Round
2  111.00 111.2 222.2 ERR   OK
3     222 111.3 333.3 ERR   OK
4     333 111.4 444.4 ERR   OK
5     444 111.5 555.5 OK    OK
6     555 111.6 666.6 ERR   OK
7     666 111.7 777.7 ERR   OK
```

Bill Satterfield
City of Albany
Albany, Ga

In 1-2-3 *Release 1A, replace "OK" with the value 1 in both formulas. Both* 1-2-3 *and* Symphony *let your hardware perform math calculations using built-in floating-point arithmetic routines. These routines store numbers as values with 15 decimal places. Unfortunately, the floating-point routines aren't perfectly accurate in the 14th and 15th decimal places. That's why you often need to round formulas that include decimal values.*

HARDWARE

BLANK SCREEN WITH DOS BATCH FILE

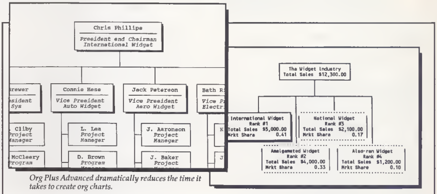
There are memory-resident programs that darken a monitor while the monitor is unused for a specified time. This prevents characters from "burning" into the monitor. You can produce the same effect by creating a DOS batch file and running it each time you won't be using your computer for a while. Such a batch file isn't memory-resident and, therefore, isn't likely to cause problems when you run programs like *1-2-3* or *Symphony*.

To create a screen-saving batch file, called BLANK.BAT, enter the following lines at the DOS prompt:

```
copy con blank.bat
prompt $E[0;30;40m$n $g
cls
pause
prompt $E[0;37;40m$p$g
cls
```

After you type *cls* and before you press Return, hold down the Control key and press Z. DOS creates a file that contains your entries. To start the batch file, enter ***blank*** at the DOS prompt. To redisplay the DOS prompt, press any key.

BLANK.BAT changes the monitor foreground color to match the black background. Then it clears the screen and pauses for keyboard input. Since the foreground and background colors are identical, the *Press any key* message, which the PAUSE command initiates, is not visible. However, when you press a



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CIRCLE 118 ON READER SERVICE CARD

key, the second PROMPT command causes the normal foreground and background colors to reappear. The numbers following the PROMPT command control the colors. The first number can be either 1 or 0; the second and third sets of numbers can have values between 30 and 47. Different combinations of numbers produce a variety of foreground and background color combinations. The final part of the PROMPT statement, $p$g, causes DOS to display the directory and the greater-than symbol (>) as the DOS prompt.

David E. Ritter
Douglassville, Pa.

This batch file will work only if your CONFIG.SYS file contains the command DEVICE=ANSI.SYS.

FIXING PAGE-BREAK PROBLEM ON EPSON LQ1050

I have an Epson LQ-1050 printer with DIP switch 2-7 set to the On position. This activates the "short tear-off" feature. This feature responds to a form-feed instruction by advancing the perforation of continuous-feed paper so that you can tear off the last printed page without wasting a sheet. However, when I use *1-2-3*'s Print Printer Align Go Page command, the printer feature does not work properly. Apparently, *1-2-3* advances the paper to the next page without issuing a form-feed instruction.

To get around this problem, I use the Worksheet Page command in the bottom-left cell of my Print range. Each printed range ends with a form-feed that causes the printer's short tear-off feature to work properly.

Rev. Jim Histand
Fairfax Baptist Temple
Fairfax, Va.

This technique doesn't work in 1-2-3 *Release 1A.*

SYMPHONY

INDEXING DATABASE REPORT

I needed to print the record number of an entry in a *Symphony* database without actually entering the record number in a separate database field. Placing the formula @CELL("row",A1..A1) in the main Report range returns 1 for the first record of the database, 2 for the second record, and so on. Also, when *Symphony* prints reports for criterion-selected records, the formula returns the correct record number for each report. Unfortunately, this formula results in errors if you insert rows at the top of the worksheet. For example, if you insert two rows above cell A1, the formula now refers to cell A3 and will print as 3 in the first record's report.

To overcome the shortcoming, expand the @CELL formula. Let's say your Database range is A100..B106, with the field names entered in row 100. Your Report range is J4..L5. Enter the following formula in the Report range where you want the number of the record to print:

```
@CELL("row",A101..A101)−
   @CELL("row",$A$100..$A$100)
```

The formula evaluates to 1 for the first record, 2 for the second, and so on—even if you insert rows at cell A1. This formula will always result in the correct record number, provided you don't insert rows between the field names and the database records. If you do insert rows directly beneath the field names, you incorrectly change all the formulas in your Report range.

Mervyn M. Smith
Fisher, Australia

REVISITED

MULTIPLE BACKUP COPIES

Lee A. Oliver's method [November] of using a batch file to keep multiple backup copies of a worksheet is useful. However, the example presented requires that you create a separate batch file for each worksheet file that you wish to back up. I've revised Lee's batch file by including the DOS RENAME command so that the batch file copies the file it's backing up only once rather than three times. Also, I've used the DOS percent operator, which lets a batch file recognize and react to parameters. My batch file lets you create multiple backup files of any file you choose. Here is a listing of the file commands:

```
REM Batch file to save 3 successive
REM versions of file.
ren %1c.%2 %1x.%2
ren %1b.%2 %1c.%2
ren %1a.%2 %1b.%2
ren %1x.%2 %1a.%2
copy %1.%2 %1a.%2
```

There are a few rules for using this batch file: (1) You must enter the file name followed by a space, not a period, then the extension. For example, to back up a file named TEST.WK1, you'd enter the command *back test wk1*. (2) The original file name of the file that you're backing up must contain no more than seven characters. The batch file adds a backup-version letter to the name of each file you backed up. (3) Run BACK BAT only once for each file update, otherwise the a, b, and c versions of the file will end up containing the same data.

Ben F. Wheeler
Ben-Comm Systems
Haddonfield, N.J.

To create the batch file, at the DOS prompt enter copy con:back.bat. *Then enter each line of the batch file as shown. After you enter the last line, hold down the Control key and press Z or press the F6 key. The ^Z closes the batch file. Now press Return. DOS should display the message* 1 File(s) copied. *If BACK.BAT is in the root directory, you must use the DOS PATH command. Otherwise, BACK.BAT must be in the subdirectory where the files that you want to back up are located.*

To create backups of file names that contain eight characters (so that FILENAME.WK1 becomes AFILENAM.WK1, BFILENAM.WK1, and so on), use the following batch file:

```
REM Batch file to save 3 successive
REM versions of file.
del c%1.%2
ren b%1.%2  c%1.%2
ren a%1.%2  b%1.%2
copy %1.%2  a%1.%2
```

DETERMINING THE CORRECT RIGHT MARGIN

Unlike the techniques of Joseph Rosebrock [January 1988] and Edward Bramlitt [September 1988], I use the following method to determine the width of the spreadsheet and hence the correct right-margin setting for my reports.

Assume your spreadsheet uses columns A through H, each with the default width of 9. In cell A2 enter the formula @CELL("width",A1..A1). This formula evaluates to 9, the column's width. Use the Copy command to copy the formula to range B2..H2. Next, enter the formula @SUM(A2..H2) in cell I2. This yields 72, the combined widths of the specified columns. Add the left-margin setting to this total to find the correct right-margin setting. When you hide a column so that it doesn't appear in the Print range, this formula correctly yields the combined widths, excluding the hidden column.

Note that the formulas aren't updated automatically when you change a column width or when you hide or redisplay a column. You must press the CALC key to recalculate the formulas. Press the CALC key whenever you set new widths.

James Bauch
Alsip, Ill.

This procedure doesn't work in 1-2-3 *Release 1A.*

1-2-3

USING DATA QUERY FIND BEFORE EXTRACT OR DELETE

The Data Query Find command is a good debugging tool to use before you use the Data Query Extract or Data Query Delete command. It lets you make sure that *1-2-3* evaluates your criterion and is manipulating the records you want. If the Query Find command highlights the records you wish to extract or delete, press Return, then select Extract or Delete to continue processing your data. If the Query Find command highlights the wrong records, your criterion must be incorrect. Use the Find command to preview the criterion selection and save time that would be wasted awaiting the completion of a database extract. More important, you prevent the disaster that might arise if a Query Delete command deleted records you'd rather keep.

Rick Robbins
New Albany, Miss.

This material is prepared by Subhadra Mattai and the Technical Editors, with the help of the Lotus Product Support staff.

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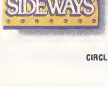

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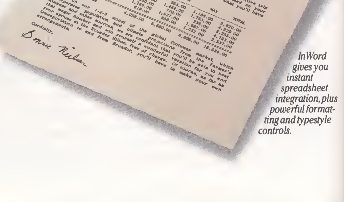

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January 24, 1987

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Cold-Boots	550.00	770.00	935.00	2,255.00
Boat Shoose'..	1,769.00	1,637.00	1,367.00	4,763.00
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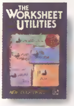
Formula Editor provides a powerful environment for entering, editing, and debugging formulas, with point/shoot menus for @functions, prompting for arguments, and an on-line @function reference manual.



Search and Replace lets you hunt through your spreadsheet for labels, values, @functions, and cell references – and optionally replace them.

AutoSave creates periodic back-ups of work-in-progress, to guard against power failures and editing mistakes.

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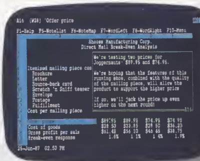

```
A16  (W28) 'Offer price
F1-Help  F5-NoteList  F6-NoteMap  F7-WordLeft  F8-WordRight  F10-Menu
                    Sheoss Manufacturing Corp.
                 Direct Mail Break-Even Analysis
                           We're testing two prices for
                           Joggernauts: $89.95 and $74.95.
Itemized mailing piece cos
  Brochure                 We're hoping that the features of this
  Letter                   running shoe, combined with the quality
  Bounce-back card         of the mailing piece, will allow the
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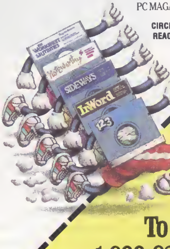

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PROTECT YOUR WORKSHEETS AGAINST DISASTER

Delete a file? Format your hard disk? *The Norton Utilities* and *Rescue Plus* can get your worksheet back.

BY HOWARD MARKS

The Norton Utilities defined the category of file-recovery software and is the best-selling such program for the IBM PC and compatibles. With it, you can quickly recover most or all of a deleted file, even if the file was deleted because you reformatted your hard disk.

Deleted worksheet files, however, pose a unique problem. Even after you recover a deleted worksheet with *The Norton Utilities*, *1-2-3* or *Symphony* may refuse to load it, instead displaying the error message *Not a valid worksheet file*. That's because the worksheet file has been damaged.

When that occurs, you'll need *Rescue Plus*, a program designed specifically for worksheet files. It can recover and repair deleted worksheet files so that you can retrieve them with *1-2-3* or *Symphony*. Even if *The Norton Utilities* can't completely recover the deleted file, chances are that *Rescue Plus* can finish the job.

While their features seem to overlap, neither program alone delivers a complete solution. In most cases, *The Norton Utilities* can completely recover a deleted worksheet file with a single command, but when it can't, only *Rescue Plus* can help. However, because it takes much more time to recover a deleted file when you are using *Rescue Plus*, you'll want to use it only when *The Norton Utilities* won't work.

Depending on your budget and your time, you may want both of the programs: *The Norton Utilities* ($150) to recover most of your deleted worksheets quickly and easily, and *Rescue Plus* ($119.95) to repair worksheets that your computer won't load and to recover deleted worksheets that *The Norton Utilities* can't recover.

UNDELETING YOUR FILES

To understand the difference between these two programs, you need to know something about how they work. File-recovery programs take advantage of the way DOS stores and deletes files. When you first save a file, DOS writes an entry for the file in the directory or subdirectory where you've saved it. A directory entry includes the file's name, size, and the date and time you created it.

When you issue a command to delete a file, DOS replaces the first letter of the file's name in the directory entry with a marker. Afterward, DOS won't let you read the file, but the file remains on the disk. As you save other files, one of them will overwrite the deleted file sooner or later. When that happens, a file-recovery program can no longer recover the deleted file. The trick is to use *The Norton Utilities* or *Rescue Plus* as soon as you mistakenly erase a file, before some other file overwrites it.

In such a situation, *The Norton Utilities* will serve you best. Its Quick Unerase feature lets you simply enter the name of the deleted file or files to make it reappear. With *Rescue Plus*, you need to go through a more complicated series of steps designed to solve more serious file-recovery problems. *Rescue Plus*'s main drawback is that it doesn't offer an abbreviated route for simple file-recovery problems.

Recovering your file entails more work if you have frequently updated your file since you first saved it. When you update and resave a file, there's often insufficient room to store the new data in the same location as the existing file. In that case, DOS stores the new data wherever else it can find room on the disk. DOS enters the location of the new data, and notes its association with the existing file, in a special DOS file known as the File Allocation Table. This table contains the location of each part of each file on the disk.

As you repeatedly update your files and save more files to your disk, files can become quite fragmented. A fragmented file is difficult to recover because the recovery program has to search out each of those scattered clusters of data. That is, it's difficult without these programs, either of which will help you recover the file.

COMPLEX RECOVERY

To recover such a worksheet file with *The Norton Utilities*, you begin by specifying the file. The program locates the first part of the file and lets you view only the labels in that section. After you confirm that the data contained there be-

---

Howard Marks is a network consultant based in New Jersey.

MICHAEL MCLAUGHLIN,

longs with the file, the program locates what it believes is the next part of the file and shows you the labels in that section. The problem with this approach is that, since many parts of a worksheet file may contain only values or formulas, you'll have no way of identifying them as part of the file when *The Norton Utilities* displays them.

Rescue Plus's more complex form of file recovery is better suited to deal with this type of deleted file. You use three programs to recover the file. The first one scans your disk for data stored in *1-2-3*'s or *Symphony*'s worksheet-file format and creates two printouts: One tells you the area of the disk, or sector, in which the first part of the file is stored; the other tells you which sectors *Rescue Plus* thinks belong to that file. You then use a second program to view all data in these sectors, which *Rescue Plus* lists cell by cell. This way you can make sure that the sectors *Rescue Plus* has chosen are actually part of the deleted file. With a third program you can reconstruct the file by simply choosing the sectors you want to include.

Because *Rescue Plus* gives you a better look at your worksheet data as you reconstruct your files, you can recover deleted, fragmented files more reliably than with *The Norton Utilities*. If your files' clusters are spread about the disk, *Rescue Plus* will reduce confusion and save time by finding only the sectors that contain worksheet data, whereas *The Norton Utilities* might select data from other programs for you to view. The drawback is that *Rescue Plus* requires you to refer to printouts, which you may find inconvenient.

WORKSHEET DOCUMENTATION PROGRAMS

After you've developed a worksheet, a worksheet documenter, such as *The Spreadsheet Auditor* (Computer Associates International, San Jose, Calif.) or the *Cambridge Spreadsheet Analyst* (Symantec Corp., Cupertino, Calif.) can make it a lot easier to reconstruct the worksheet in the event that it is damaged. These programs let you print the contents of every cell: formulas, labels, and values. If you can't recover all of your worksheet, you can use your last printout to provide key formulas or other entries. Used in connection with *Rescue Plus*, which won't recover data from bad disk sectors, a worksheet documenter lets you fill in the pieces of data that were stored in bad sectors.

The manufacturers of both programs agree that as long as you use *The Norton Utilities*' Quick Unerase feature promptly, that program will completely recover your deleted files 80% to 85% of the time. However, if your worksheet has been scattered about your disk, *Rescue Plus*'s more complex approach is more effective at recovering your data.

DAMAGED FILES

Sometimes DOS cannot read your worksheet file because part of the disk on which it's stored has been rendered unusable. That unusable part of the disk is known as a bad sector. In such a case, *The Norton Utilities* will try to move the data stored in the bad sector to a good sector and make the file readable again.

But often even if DOS can read a worksheet file you've recovered or repaired with *The Norton Utilities*, *1-2-3* or *Symphony* cannot. This usually means that even though you've recovered the data, it's no longer in a form *1-2-3* or *Symphony* can recognize.

In such an instance, you'll need *Rescue Plus*, which patches the damaged part of the file so that *1-2-3* or *Symphony* can read it. Repairing a worksheet file with *Rescue Plus* is as simple as recovering a file with *Norton*'s Quick Unerase—you enter the damaged file's name, and *Rescue Plus* repairs the file. The program attempts to recover what data it can from the bad sector. If you regularly use a spreadsheet documentation program (see box), you can probably replace the missing data easily enough; otherwise, you'll have to rely on your memory.

Both programs offer a further measure of protection. In the event that you accidentally reformat a hard disk, either program can recover most or all of your files. To recover files from an accidentally reformatted hard disk, *The Norton Utilities* and *Rescue Plus* take advantage of a little-known fact about DOS. DOS doesn't actually reformat your hard disk when you tell it to. Instead, it rebuilds your root directory to eliminate the files stored there and similarly rebuilds DOS's File Allocation Table so that it no longer lists the areas of the disk that each of your files occupy. Except for files stored in your root directory, most of your data remains on the hard disk where either program can find it.

The Norton Utilities' Unformat command tries to recover your files and directory structure. You can run the procedure once, and it will work over the entire hard disk. *Rescue Plus* recovers only your worksheet files, and it does so in the same way you'd recover those files if you had deleted or erased them.

Neither of these recovery operations works with floppy disks. DOS really formats your floppies, so once you reformat one, your data is irrecoverably lost.

If you plan ahead, you can recover all data from a formatted hard disk. *The Norton Utilities* comes with a program that can generate a disk-based record of all your root directory files. That file remains where it can be read even after reformatting, and it lets *The Norton Utilities* recover all your data—including the files in your root directory.

Rescue Plus also offers extra protection. The package includes an add-in for *1-2-3* Releases 2/2.01 and all releases of *Symphony* that automatically creates a backup file for your worksheet as soon as you retrieve that worksheet from the disk. Then, while you work, it saves the worksheet to that backup file every 1 to 120 minutes, as you specify.

A less common but no less frustrating way to lose access to your data is to forget the password for a protected worksheet file. *Rescue Plus* includes a program that can find passwords hidden in worksheet files occupying 5K or more of disk space. If your file is smaller than 5K, *Rescue Plus* can usually find only part of your password, but that may still be enough to jog your memory. ■

IN BRIEF

The Norton Utilities Advanced Edition Version 4.5. Peter Norton Computing, 100 Wilshire Blvd., Suite 900, Santa Monica, CA 90401; 213-319-2000. Runs on the IBM PC, PC XT, PC AT, PS/2, and compatible computers. Requires 196K of RAM, DOS 2.0 or higher, and one floppy-disk drive. Released 10/88. $150. 90-day warranty against defective disks.

Rescue Plus Version 2.0. Spectrum Computer Services, 133 Main St., Suite 209, North Reading, MA 01864; 800-541-4370, in Mass. 617-664-0337. Runs on the IBM PC, PC XT, PC AT, PS/2, and compatible computers. Requires 256K of RAM and DOS 2.0. Works with all versions of *1-2-3* and *Symphony*. Released 4/88. $119.95. 30-day, money-back guarantee.

WHAT dBASE IV HAS THAT dBASE III PLUS DOESN'T

It's faster and easier to use, but it has a few rough edges.

BY TOM CARLTON AND BILL LAWRENCE

dBase IV makes it possible for someone with no programming background to create programmed, menu-driven database applications. If you already program with the dBase programming language, the new version's improvements in that language and in the program's overall capabilities will delight you also. Whichever group you fall into, if you've been using *dBase III Plus*, you'll welcome something else about *dBase IV*—its speed.

dBase IV's new menu-driven interface, called the Control Center, lets you use most of *dBase IV*'s features—certainly more than *dBase III Plus*'s Assistant ever did for that version. You can use the interface to create sophisticated data-entry forms, build queries from multiple database files, design reports and mailing labels, and then tie everything together into a single, menu-driven database application.

If you're a dBase programmer, you'll find it much easier to maintain indexes and control network access in *dBase IV* than in *dBase III Plus*. You have more options for controlling user input, and you can use a number of new mathematical and financial functions. Almost all of your existing applications will run faster in *dBase IV*.

You may, however, miss all the third-party compilers and libraries that do not yet work with *dBase IV*, especially if you develop database applications to be used by others. A special Developer's Edition of *dBase IV* is currently available for an additional $500. But the dBase Professional Compiler that it's supposed to contain, which allows you to create stand-alone *dBase IV* applications, isn't ready yet.

Other problems may bother you. *dBase IV* lets you use Structured Query Language (SQL) commands, but only at the expense of some of dBase's own functionality. The program's facilities for importing *1-2-3* data remain only adequate, and its new debugger is unnecessarily inconvenient to use.

Finally, we encountered a number of bugs while testing *dBase IV*. We could circumvent most of them, but some bugs were both unavoidable and detrimental to basic tasks. One of them, which affects *dBase IV*'s indexing feature, can render your database temporarily inaccessible. The only fix we could find necessitates erasing all your indexes for that database.

The Control Center, *dBase IV*'s new menu interface, guides you as you create the elements of a complete database application—from your database file itself, to your queries, to your data-entry forms, to reports. You then use the Application Generator to link all the pieces together into what *dBase IV* calls a catalog. When you want to work with a database application, you simply retrieve its catalog, and the Control Center displays a list of all the query, form, report, and database files that you have linked to it.

VISUAL APPROACH

Taking a cue from other database products, most notably *Paradox*, the Control Center is more visually oriented than previous *dBase* releases. For example, when you build a query, the Control Center shows you a diagram of the structure of the database you are working with. You then highlight the fields you want to use in your query and press a function key to select them. If you want to build a query incorporating files from several databases, the Control Center shows you a diagram of each, and you simply highlight the desired fields. To build a query across multiple database files in *dBase III Plus*, you have to use the dBase programming language to relate the files to each other. The Control Center simplifies the task and eliminates the need to program.

The Control Center also lets you filter your database, or display only those records you wish to see, by typing criteria into the appropriate field of the query diagram. For example, if you want to filter your mailing database to display only those records with addresses in California, you type ="CA" in the state field on the query diagram.

The Control Center's visual approach also makes it easier to design forms and reports. Using menus, you can add boxes

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Tom Carlton is manager of corporate analysis at a midwestern Fortune 500 firm. Bill Lawrence is a network engineer at Southern California Edison Co.

and lines, different colors, and text to make your forms easier to use. To prevent data-entry errors, you can also design your form to check data, as it's being entered, against any criteria you specify. In contrast, *dBase III Plus*'s Assistant produces a standardized entry form for all applications. To add colors or incorporate criteria for checking entries, you have to write your own programs.

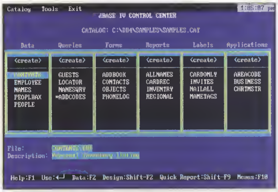
The Control Center's report generator gives you more flexibility than the Assistant, which limits you to columnar reports. With the Control Center, you create a symbolic representation of what the finished report will look like, placing your fields and accompanying text wherever you like. This is an especially convenient way to produce reports that write checks, print invoices, or fill out forms. To do the same in *dBase III Plus*, you have to resort to the programming language.

Mailing labels are especially easy to design with the Control Center. You specify the dimensions of your label, and the program generates a diagram of your label on the screen. But if you need to eliminate leading or trailing blanks in your field entries so that extra spaces don't appear on your labels, you may run into difficulty. The Control Center provides this capability in its menu, but the documentation for this feature is unclear. It took several attempts to get the results we wanted.

THE APPLICATION GENERATOR

dBase IV's Application Generator is also available through the Control Center menus. The Application Generator lets you use menus to tie together your forms, queries, and reports. However, this isn't a quick-and-dirty path to application creation. It's complex and takes effort to master. But the reward is worth it. You have total control over the interface of your application, including your menus, screen colors, and the size and positioning of your windows. This is a great improvement over *dBase III Plus*'s Application Generator, which is not accessible using the Assistant's menus, lets you create menus for only the most basic tasks, and gives you no control over the appearance of your screen.

If you're a skilled dBase programmer, you may find that the Application Generator helps you build menus more quickly than you can with manual programming, while it lets you retain the control manual programming bestows. You'll also appreciate that, unlike the Assistant, all elements of the Control Center produce editable dBase code. You can save lots of programming time and effort if you create the basis of your application with the Control Center and then modify the application with your own code.



```
Catalog   Tools   Exit                                        1:05:07 pm
                        dBASE IV CONTROL CENTER

                    CATALOG: C:\DB4\SAMPLES\SAMPLES.CAT

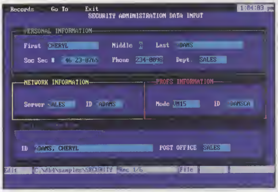
   Data       Queries      Forms      Reports      Labels    Applications
 <create>    <create>    <create>    <create>    <create>    <create>

 EMPLOYEE    GUESTS      ADDBOOK     ALLNAMES    CARDONLY    AREACODE
 NAMES       LOCATOR     CONTACTS    CARDREC     INVITES     BUSINESS
 PEOPLBAX    NAMESQRY    OBJECTS     INVENTRY    MAILALL     CHRTMSTR
 PEOPLE      *ADDCODES   PHONELOG    REGIONAL    NAMETAGS

File:
Description:

Help:F1  Use:←┘  Data:F2  Design:Shift-F2  Quick Report:Shift-F9  Menus:F10
```

The heart of *dBase IV* is the Control Center. It organizes the elements of a database application—data files, queries, forms, labels, and reports—into a menu-driven catalog.



```
Records     Go To     Exit                                    1:04:03 pm
                    SECURITY ADMINISTRATION DATA INPUT

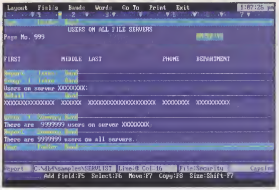
 PERSONAL INFORMATION
   First  CHERYL          Middle        Last  DAMS
   Soc Sec #  46-23-8765  Phone 234-0098    Dept.  SALES

 NETWORK INFORMATION                 PROFS INFORMATION
   Server  ALES    ID  ADAMS           Node VM15      ID  DAMSCA

   ID  ADAMS, CHERYL                  POST OFFICE  SALES

Edit   C:\db4\samples\SECURITY  Rec 1/6      File
```

The form designer grants complete control over your form's appearance. You can draw boxes and lines, change colors, and position fields any way you like.



```
Layout  Fields  Bands  Words  Go To  Print  Exit                1:07:26 pm
                    USERS ON ALL FILE SERVERS
Page No. 999

FIRST               MIDDLE  LAST                  PHONE    DEPARTMENT

Users on server XXXXXXXX:

XXXXXXXXXXXXXXX  XXXXXX  XXXXXXXXXXXXXXXXXXXX  XXXXXXXX  XXXXXXXXXX

There are  9999999 users on server XXXXXXXX.

There are 9999999 users on all servers.

Report  C:\db4\samples\SERVLIST  Line:8 Col:16  File:Security      CapsIns
         Add field:F5  Select:F6  Move:F7  Copy:F8  Size:Shift-F7
```

dBase IV lets you design custom reports without programming. To design a section of a report, you simply arrange the text and representations of each field under the appropriate band.

The Control Center contains a few frustrating quirks. When printing a report or a series of mailing labels, *dBase IV* advances the paper prior to printing unless you instruct it to do otherwise. This is an odd default. It wastes paper and makes it difficult to align your labels—and the way to change it is hard to find. Also, when you design a form with boxes and text, highlighting a box to change its colors or size often causes the boxes or the text to shift position on the form, forcing you to do some reediting to put things right.

INDEXES, NETWORKS, AND SPEED

Most database products let you index your fields so that you can quickly locate records based on a certain field. For example, if you want to find all the California addresses in your mailing database, you can do so more quickly if you've indexed the state field.

In *dBase III Plus*, indexes are difficult to manage because you have to store each index as a separate file. When you work on an application, you have to keep each related index file open so that *dBase III Plus* can update them to reflect any changes you make to your database. It's common to have several indexes for a database application, and keeping all those index files open can cause problems. For instance, if some index files aren't open while you add more records to a file, you have to remember to instruct the program to update those indexes when you're done working.

dBase IV's Production Index option solves the problem by letting you create a single file, containing up to 47 indexes, for each database. Once you index a field, the index is automatically maintained as you add or delete records containing data from that field.

However, our testing revealed a

few flaws in this new convenience. Suppose you create an index in which certain database fields are processed with some of *dBase IV*'s functions. (These functions are comparable to *1-2-3*'s or *Symphony*'s @functions.) If you try to rename one of those fields or to delete one of those fields from your database, *dBase IV* may not let you. If you manage to do so, you may lose access to the database file. To recover access to the file, you'll have to exit to DOS and delete the entire index file—and thereby lose all your indexes for that database file. Also, you may forfeit access to your database if you change any field from one type to another (for example, from a character field to a numeric field) and then try to index the field in the same step.

dBase IV is faster than *dBase III Plus* when performing most tasks. In our tests *dBase IV* ran five to seven times faster than its predecessor when processing a simple program loop. You can expect file-access speed to improve from 20% to 300% over *dBase III Plus*, depending on the operation you perform (see table). Unlike its predecessor, *dBase IV* can also use a math coprocessor, which enables it to perform mathematical calculations more quickly and may speed up work you do with unindexed files.

However, menus created with the Application Generator run slowly. On a 8088-based computer, it can take tens of seconds to move from one submenu to another. The only way around this problem is to write your menus with the dBase programming language.

If you run *dBase IV* on a network, you can automatically lock files and records. With *dBase III Plus* you have to program your locks into each application, and that's difficult. *dBase IV* can also automatically update your screen with any changes made by others to records you are viewing.

Because of the memory required by most networks and *dBase IV*'s own large memory requirements, most network implementations require that you use a third-party add-in board, such as HiCard ($225 to $825, depending on your computer, RYBS Electronics, Boulder, Colo.), to make more memory available. According to the manuals, Novell networks are the only exception to this rule.

AN IMPROVED LANGUAGE

If you are already a dBase programmer, you'll find the new commands and functions to be logical extensions of what you already know. In fact, many resemble the features already added to the language by third-party compilers and libraries. If you are a beginning programmer, the improvements will make it easier to perform some basic programming tasks.

dBase IV gives you more tools for controlling data entry than *dBase III Plus*. You can specify a condition you wish the input to meet, as well as the error message you want to display if the input doesn't meet that condition. You can also specify a series of entries as a transaction. *dBase IV* stores these entries in a temporary file, but it makes no changes to your data files and indexes until the entire transaction is complete. This feature is especially effective for correcting and preventing large data-entry errors.

For instance, if, while working with an accounting application, you realize that you're posting the wrong day's invoices, you can roll back the entire transaction instead of deleting each individual invoice. If you specify that the dollar value of the day's invoices must match that of the product shipped, and the two values don't match, you can instruct *dBase IV* not to enter the invoices until the problem is found and corrected.

New commands allow you to create

WHAT ABOUT FOXBASE+ AND CLIPPER?

Many of the improvements in *dBase IV* were added to keep users from switching to one of many third-party products that run *dBase III Plus* applications faster than *dBase III Plus*. Typically, these products also offer more functionality and programming options.

One of the most popular of these products, *FoxBase+* ($395, Fox Software, Perrysburg, Ohio), is a *dBase* "work-alike" that runs *dBase* applications several times faster than *dBase III Plus*. *Fox Base/386* ($595), a version of *FoxBase+* designed for 80386-based computers, runs those applications faster still.

FoxBase+ improves upon *dBase III Plus*'s programming language with new commands for controlling the screen display, building menus, and creating your own functions for specific calculations. *FoxBase+* also lets you build arrays of memory variables. These arrays let you write database records to your computer's memory, where you can manipulate them faster than you can on disk.

Clipper ($695, Nantucket Corp., Los Angeles, Calif.), a dBase language compiler, transforms *dBase III Plus* applications into stand-alone programs that run without *dBase III Plus* and run several times faster than their *dBase III Plus* counterparts. If you write dBase programs for novice dBase users, these stand-alone applications can save them the expense and trouble of buying and learning *dBase III Plus*. *Clipper* includes language enhancements similar to those in *FoxBase+*.

dBase IV's new features match or exceed those of either third-party product. *dBase IV* gives you more control of the screen, lets you create a greater variety of menus, and lets you build larger memory arrays. Neither *FoxBase+* nor *Clipper* offers anything like *dBase IV*'s menu-driven Control Center for building queries, forms, and reports and for combining them into database applications. And while both third-party products manage indexes more efficiently than *dBase III Plus*, neither can match *dBase IV*'s Production Index for ease of use.

While I did not test *FoxBase+* for this review, people who have used both *FoxBase+* and *dBase IV* describe their speed as comparable. Until *dBase IV*'s dBase Professional Compiler (yet to be released for the Developer's Edition) is made available, a performance comparison with the *Clipper* compiler is impossible.

One final note. *dBase IV* includes several new functions for specialized calculations. These functions are comparable to Lotus's @functions. There is, however, an even greater number of third-party functions that add capability to *FoxBase+*, *Clipper*, and *dBase III Plus*. If you're using third-party functions now, there is no guarantee that they will work with *dBase IV* or that they will be upgraded to do so. If you're an experienced dBase programmer, you can re-create the functions you need in *dBase IV*. Otherwise, check with the third-party manufacturer for information on compatibility or upgrades. —*B. L.*

windows, write pop-up and pull-down menus, and control screen colors. You'll find 18 new mathematical and financial functions, most of which have direct counterparts in *1-2-3* or *Symphony*. Most of the mathematical functions are useful for engineering and scientific applications, while the financial functions perform calculations to determine the time value of money. If you need to convert a Lotus worksheet that makes these calculations into a *dBase IV* database, you can use these new functions to substitute for their *1-2-3* or *Symphony* equivalents.

SPEED COMPARISON: DBASE IV VS. DBASE III PLUS

	dBase IV	dBase III Plus
Execute simple program loop	:15	1:39
Append 1,279 records to a database file	:13	:31
Sort 10,232 records based on one numeric field	4:34	7:05
Copy 10,232 records to a new database based on one numeric field	2:35	3:46
Find and replace 1,279 unindexed records	:13	:16
Find and replace 10,232 records using an index	16:49	24:19
Find 10,232 records using an index and update an indexed field	38:37	49:33

All tests were performed using a Compaq Deskpro 386 running at 16 MHz, with a 2K memory cache enabled. Times are shown in minutes and seconds.

dBase IV lets you create arrays of memory variables. With them you can improve performance by manipulating records in memory rather than writing to the disk every time you make a change. For example, if you are designing a data-input process for a network application, you can write a series of records to a memory array first. Then you can write all the records to your disk file in one final step. This speeds up your application and minimizes the time that you have to keep your records locked.

dBase IV also comes with a debugger to help you find and correct programming errors. Although the debugger is easy to use, it has one frustrating limitation. A common debugging technique is to stop the execution of a program at certain points so that you can tell which sections of the program are not functioning properly. With the *dBase IV* debugger, however, you cannot mark the points in your program where you want to stop. Instead, you have to determine these stop points with a dBase conditional expression. This is more work, and you may not always be able to write a conditional statement that stops the program where you want.

If you want more programming tools, you can get them in the *dBase IV* Developer's Edition. These additional tools include a run-time program, which enables others to run your programs without dBase; a linker, which combines your main program and procedure files into one file for faster execution and better use of memory; and a card entitling you to the dBase Professional Compiler, which hasn't been released yet.

The Developer's Edition also includes a programmer's guide, which provides a detailed explanation of the dBase language, complete with examples. The standard *dBase IV* package includes only a command reference. If you are currently a skilled *dBase III Plus* programmer, the Developer's Edition is probably worth the extra expense, but you may not want to upgrade until the promised compiler is released.

SPECIAL PROBLEMS

Structured Query Language lets you use English-like programming commands to retrieve information from your database. SQL is especially powerful for performing frequent and diverse queries.

dBase IV's implementation of SQL, however, can frustrate you at times. To use SQL commands to query a particular database, you must run a special procedure that defines that database as an SQL file. After doing this, you can no longer use *dBase IV*'s menu or language commands to add indexes to the database or modify its field structure. Instead, you'll have to write more SQL code to perform these common database tasks. Other database programs, such as *RBase* ($725, Microrim, Redmond, Wash.) and *Oracle* ($1,295, Oracle Corp., Belmont, Calif.), do a better job of combining their own functionality with SQL.

dBase IV's file-import feature is fast enough to import a 3,500-row worksheet in only 43 seconds, but it will disappoint you in other ways. You can't import selected worksheet ranges; you must import the entire worksheet. If you want to import data from only certain ranges, you have to use *1-2-3*'s or *Symphony*'s File Extract command to create a file containing only those ranges. And you can't always rely on *dBase IV* to convert your range formats properly. In our tests a column containing values in *1-2-3* was sometimes converted in *dBase IV* to a character field instead of a numeric field. This happened even if the range was formatted as currency or as a fixed decimal.

dBase IV can discourage you if you frequently update an imported database by reimporting data from *1-2-3*. *dBase IV* automatically overwrites your database with the newly imported file. However, it does not build a new index file for the database. If the new database's field names and field types don't match those in the old index, you could lose access to the database. Once again, the only remedy is to exit to DOS and delete the index file.

dBase IV comes with an excellent tutorial. But the nine booklets of documentation are disjointed in some ways. For example, you have to consult several manuals to learn about a fundamental topic like indexing. The explanation, when found, is often shallow. ■

IN BRIEF

dBase IV Version 1.0. Ashton-Tate, 20101 Hamilton Ave., Torrance, CA 90502-1319; 213-329-8000. Runs on the IBM PC XT, PC AT, PS/2, and compatible computers. Requires DOS 2.0 or higher, 640K of RAM, one floppy-disk drive, and a hard disk with 3.5 megabytes of unused space. Released 11/88. $795; $175 to upgrade from any earlier version. 90-day warranty against defective disks; 90 days free technical support.

dBase IV Developer's Edition includes Run-Time with unlimited license, three LAN keys, *dBase IV* Template Language, advanced debugger, dB-link linker, added documentation, and free upgrade to the dBase Professional Compiler, when released. $1,295; $475 to upgrade from any earlier version.

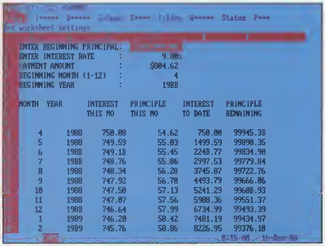
dBase IV for OS/2 (expected release first quarter 1989). No charge if DOS-version disks exchanged. $100 if DOS-version disks are kept.

LAN Pack. Adds five LAN authorizations (for a total of six LAN authorizations). $995.

1-2-3 WORKSHEETS THAT RUN WITHOUT 1-2-3

Compile 1toC may be the fastest compiler yet.
Still, it offers less functionality than *1-2-3* itself.

BY BILL LAWRENCE

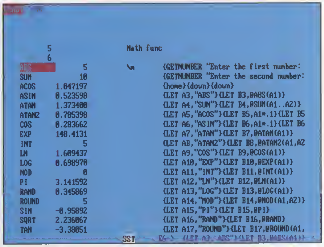


```
 I*****  D*****          E****          W*****  Status  P***
et worksheet settings
                                                   E           F
 ENTER BEGINNING PRINCIPAL:
 ENTER INTEREST RATE      :           9.80%
 AYMENT AMOUNT            :         $804.62
 BEGINNING MONTH (1-12)   :               4
 BEGINNING YEAR           :            1988

 MONTH  YEAR      INTEREST  PRINCIPLE   INTEREST  PRINCIPLE
                  THIS MO   THIS MO     TO DATE   REMAINING

     4    1988     750.00       54.62     750.00   99945.38
     5    1988     749.59       55.03    1499.59   99890.35
     6    1988     749.18       55.45    2248.77   99834.90
     7    1988     748.76       55.86    2997.53   99779.84
     8    1988     748.34       56.28    3745.87   99722.76
     9    1988     747.92       56.70    4493.79   99666.06
    10    1988     747.50       57.13    5241.29   99608.93
    11    1988     747.07       57.56    5988.36   99551.37
    12    1988     746.64       57.99    6734.99   99493.39
     1    1989     746.20       58.42    7481.19   99434.97
     2    1989     745.76       58.86    8226.95   99376.10
                                              8:15 AM  16-Dec-88
```

FIGURE 1. ***Compile 1toC*****'s run-time program re-creates the *1-2-3* environment almost completely. The asterisks in the menu indicate commands that either don't work with *Compile 1toC* or were disabled by choice.**



```
        5             Math func
        6
ABS           5       \m       {GETNUMBER "Enter the first number:
SUM          10                {GETNUMBER "Enter the second number:
ACOS   1.047197                {home}{down}{down}
ASIN   0.523598                {LET A3,"ABS"}{LET B3,@ABS(A1)}
ATAN   1.373400                {LET A4,"SUM"}{LET B4,@SUM(A1..A2)}
ATAN2  0.785398                {LET A5,"ACOS"}{LET B5,A1*.1}{LET B5
COS    0.283662                {LET A6,"ASIN"}{LET B6,A1*.1}{LET B6
EXP    148.4131                {LET A7,"ATAN"}{LET B7,@ATAN(A1)}
INT           5                {LET A8,"ATAN2"}{LET B8,@ATAN2(A1,A2
LN     1.609437                {LET A9,"COS"}{LET B9,@COS(A1)}
LOG    0.698970                {LET A10,"EXP"}{LET B10,@EXP(A1)}
MOD           0                {LET A11,"INT"}{LET B11,@INT(A1)}
PI     3.141592                {LET A12,"LN"}{LET B12,@LN(A1)}
RAND   0.345869                {LET A13,"LOG"}{LET B13,@LOG(A1)}
ROUND         5                {LET A14,"MOD"}{LET B14,@MOD(A1,A2)}
SIN    -0.95892                {LET A15,"PI"}{LET B15,@PI}
SQRT   2.236067                {LET A16,"RAND"}{LET B16,@RAND}
TAN    -3.38051                {LET A17,"ROUND"}{LET B17,@ROUND(A1,
                      SST    E6-> {LET A3,"ABS"}{LET B3,@ABS(A1)}
```

FIGURE 2. The program makes it easier to debug macros because you can display each step ot the macro at the bottom of the screen before executing it. You can use all but one of *1-2-3*'s macro keywords in *Compile 1toC*.

With *Compile 1toC* you can transform your *1-2-3* worksheets into stand-alone applications. If you need to create worksheets for novices, you're likely to prefer these applications to *1-2-3* worksheets for several reasons:

- Stand-alone worksheets can spare people who don't need *1-2-3* the expense of buying it.
- These worksheets are less prone to accidental damage than *1-2-3* worksheets.
- The stand-alone worksheets let you hide your macros and formulas to prevent copying or tampering.
- If your worksheets contain macro-executed formulas or many copied formulas, stand-alone applications make those formulas calculate faster.

In exchange for these benefits, you forfeit access to some significant *1-2-3* features, including graphics, two statistical commands, and one macro keyword. These omissions may force you to redesign your worksheets before using the product, and you may have to leave out some functions. A subsequent version of *Compile 1toC*, which includes graphics, was not available at the time of this review.

Nevertheless, *Compile 1toC* may be the best of its breed. Its nearest competitor, *Baler* ($495, Brubaker Software, West Lafayette, Ind.), is less expensive and lets you include graphs in your applications. But *Compile 1toC* transforms a worksheet into a stand-alone application much more quickly, and it creates faster worksheets than does *Baler*. (For more on *Baler*, see the review in the March 1988 issue.)

TRANSFORMING THE WORKSHEET

Compile 1toC transforms, or compiles, your worksheet into a C-language program. The process is automatic. Once you've created your worksheet, *Compile 1toC* does the rest. Users run the compiled worksheet with *Compile 1toC*'s run-time program, which simulates *1-2-3*'s environment and most of its functionality (see figure 1).

You can choose between two licenses for distributing the run-time program: a $299 license that permits you to distribute up to 10 copies, and an $899 license that permits unlimited distribution. *Baler*'s license for unlimited distribution is about $400 less. Still, if you distribute only four run-time programs under *Compile 1toC*'s unlimited license, it will cost less than buying an equal number of *1-2-3* copies to distribute with your application.

Compile 1toC lets you customize your compiled worksheet. You can control whether the user can display the menu, and you can eliminate commands from the menu. For example, if you run financial applications, you might turn off the Range Format command to ensure that

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Bill Lawrence is a network engineer at Southern California Edison Co.

the numbers remain formatted as currency. These features help prevent inexperienced users from using commands that could damage your worksheets or from being overwhelmed by unnecessary commands.

TESTING AND EDITING MACROS

Once you've compiled your worksheet, you can permanently hide your macros to protect them from accidental damage or unauthorized duplication. If you choose not to hide the macros, experienced users can take advantage of a feature that makes it easier to test and edit macros. To help you pinpoint problems with a macro, the program lets you display each macro statement at the bottom of the screen before you press a key to execute it (see figure 2). Although *1-2-3* also lets you execute macros one step at a time, you can't always tell which step of the macro *1-2-3* is executing. As a result, problems are harder to trace.

> **A WORKSHEET CONTAINING 360 ROWS OF COPIED FORMULAS RECALCULATED 10 TIMES FASTER WHEN COMPILED WITH COMPILE 1TOC.**

While you can edit macros in *Compile 1toC*, you can't move or change compiled formulas. That means *Compile 1toC* won't let you do some of the things you do most often with *1-2-3*. For example, you can't insert or delete rows or columns. If you try to copy or move a cell containing a formula, you'll copy the calculated value, but the formula will remain in its original cell. You can't enter new formulas into worksheet cells either. These limitations mean that the compiled application must be a static one, such as a budget template into which you enter new values but not new formulas.

In addition to the Graph commands, three commands from *1-2-3*'s Data submenu—Table, Matrix, and Regression—do not work in *Compile 1toC*. That means worksheets used for what-if or advanced statistical analysis are bad candidates for compiling. Macros that include these commands also won't work.

The program imposes another limitation on macros: When macros contain @functions, the @functions cannot use calculated arguments. For example, if you want to write a macro to multiply the numbers in cells A1 and A2 and then round the result to the nearest hundred, you typically write the statement {LET A3,@ROUND(A1*A2,2)}. For the statement to work in a compiled worksheet, you have to rewrite it as {LET A3,A1*A2} {LET A3,@ROUND(A3,2)}. By comparison, *Baler* does not let you include @functions in your macro code; you have to place @functions elsewhere and reference their location from within the macro.

Compile 1toC can handle most macro functions, with one important exception—the {DEFINE} keyword. That'll frustrate you if you often write macro subroutines and pass values to them. You can work around this deficiency simply enough, but it's ironic that a tool that appeals to sophisticated macro writers does not support a keyword that helps you write compact, efficient macros.

PERFORMANCE

In my tests, *Compile 1toC* took 10 minutes to compile a 30-year mortgage-amortization worksheet containing 360 rows of copied formulas. *Baler* took four hours to do the same work. The *Compile 1toC* version recalculated 10 times faster than the original *1-2-3* worksheet, almost half again as fast as the same worksheet compiled with *Baler*.

In general, worksheets such as the one described recalculate much faster when compiled with *Compile 1toC* because *Compile 1toC* consolidates repetitive calculations. The fewer copied formulas in a worksheet, the smaller the improvement in speed that compiling will yield.

The program also executes macros faster than *1-2-3*. I redesigned the amortization worksheet to have a macro calculate each payment. When compiled with *Compile 1toC*, this redesigned worksheet ran about one-third faster than it did as a *1-2-3* worksheet. When I compiled the same macro-driven worksheet with *Baler*, it ran three times slower than the original *1-2-3* version.

While compiling, *Compile 1toC* tries to conserve memory by disabling all empty cells in your worksheet except those cells it determines will store data or figure in your formulas. If the program guesses incorrectly, you can't reenable cells without recompiling. The manual recommends several ways to prevent any incorrect guesses, but doing so means more work for you.

LIMITATIONS

Some worksheets may be too big to compile. For example, in my tests a worksheet that took up 343,674 bytes on the disk was too large to compile successfully. You may also have a problem if your worksheet requires expanded memory. *Compile 1toC*'s run-time program can use only 64K of expanded memory. Any worksheet that uses expanded memory is likely to need more than that.

I found an undocumented quirk while testing *Compile 1toC*. The program does not recognize all of *1-2-3*'s options for highlighting a range. For example, if you name a range that contains a macro by using the Arrow and End keys to highlight all the text in the macro, the range may disappear after compiling, without displaying an error message. The program behaves more reliably when you name that range by using the Range Name Create command.

With this exception, *Compile 1toC*'s manual clearly explains the program's incompatibilities with *1-2-3* and suggests ways to work around them. But you need a solid grasp of *1-2-3* and DOS to follow them. In all but the most fully macro-driven applications, users still need some *1-2-3* knowledge. A nice addition to the package, therefore, would be a run-time manual you could copy and distribute with your application and the run-time program. ■

IN BRIEF

Compile 1toC Version 1.5. Resource Analysis International, 12581 Venice Blvd., Los Angeles, CA 90066; 800-877-6788. Runs on the IBM PC XT, PC AT, PS/2, and compatible computers. Requires DOS 2.0 or higher, 640K of RAM, and one floppy-disk and one hard-disk drive. Released 9/88. Prices by license: License-Personal Version, to distribute 10 copies of the *Compile 1toC Runtime*, $299; License-Corporate Version, to distribute unlimited copies of the *Compile 1toC Runtime*, $899. Upgrade from Personal to Corporate License, $600. 90-day warranty against defective disks.

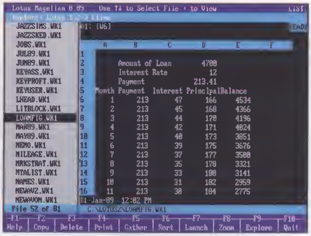
Lotus Magellan: Helps You Find Information Fast

If you remember the information you want but not what file you stored it in or that file's location on your hard disk, *Lotus Magellan* can help. On an IBM PC AT or compatible computer, *Magellan* can search the entire hard disk for any word or numeric expression in several seconds. If the data files containing the desired information were created with most Lotus text-based programs or with any of seven other programs, *Magellan* will display the textual contents of the files that contain them.

When the search is complete, *Magellan* shows in the window on the left side of the screen a list of all the files that contain the word or numeric expression. As you move your arrow keys to highlight a file in the list, *Magellan* displays that file in the window on the right—exactly as it appears in the program you created it with, complete with that program's screen colors and cursor-movement commands.

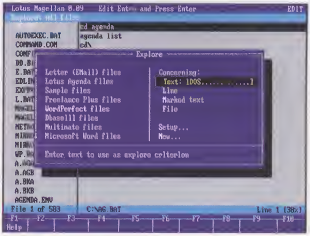
As an alternative to searching, *Magellan* will display all your file names, or any subset thereof, sort them, and let you scroll through them. As you scroll, it will display the contents of compatible files just as it does with the files it found by searching.

You can't edit a file in *Magellan*'s display, but *Magellan*'s Launch command lets you load the program you created the file with, as well as the file itself. When you "launch" a program, *Magellan* unloads all but 4K of itself from memory. When you exit the launched application, *Magellan* returns you to where you were prior to launching it.



```
Lotus Magellan 0.89    Use ↑↓ to Select File → to View                LIST
 JAZZSIMS.WK1    1: [W6]
 JAZZSKED.WK1
 JOBS.WK1              A        B        C        D        E        F
 JUL89.WK1      1
 JUN89.WK1      2        Amount of Loan           4700
 KEYASS.WK1     3        Interest Rate              12
 KEYPROFT.WK1   4        Payment                213.41
 KEYUSER.WK1    5  Month Payment  Interest PrincipalBalance
 LHEAD.WK1      6      1      213       47      166     4534
 LITBLOCK.WK1   7      2      213       45      168     4366
 LOANFIG.WK1    8      3      213       44      170     4196
 MAR89.WK1      9      4      213       42      171     4024
 MAY89.WK1     10      5      213       40      173     3851
 MEMO.WK1      11      6      213       39      175     3676
 MILEAGE.WK1   12      7      213       37      177     3500
 MRKSTRAT.WK1  13      8      213       35      178     3321
 NTALIST.WK1   14      9      213       33      180     3141
 NAMES.WK1     15     10      213       31      182     2959
 NEWAVZ.WK1    16     11      213       30      184     2775
 NEWAVON.WK1   01-Jan-89  12:02 PM
File 52 of 81    C:\LOTUS2\LOANFIG.WK1
```

The left side of *Magellan*'s split screen displays file names; the right side displays the highlighted file. *Magellan* can display files created with most Lotus text-based programs and seven other programs.



```
Lotus Magellan 0.89    Edit Entry and Press Enter                    EDIT
                  cd agenda
 AUTOEXEC.BAT     agenda list
 COMMAND.COM      cd\
 A.AGB
 A.BKA
 A.BKB
 AGENDA.ENV
File 1 of 583     C:\AG.BAT                                  Line 1 [38%]
```

When searching for a file in *Magellan*, you can specify an application or group of applications and a specific text string as criteria. You can also save criteria for searches you make regularly.

The program also lets you copy, move, delete, or print single files or groups of files. You can, for example, move a file to another subdirectory or delete all files created before a certain date. You can gather several files into a new file or use *Magellan*'s cut-and-paste features to create a file from information in several files.

Magellan's macro facility enables it to search files and perform information-handling tasks automatically. Suppose you use a telecommunications program that you can program to call on-line news databases. You can receive news articles early every morning and have *Magellan* act like an automated clipping service: It can search the news files for your special interests, cut references, combine the references into one file, and print the whole thing before you arrive at the office.

It takes some time for *Magellan* to index your hard disk the first time: 15 to 90 minutes for a full 40-megabyte hard disk, depending on your equipment and the type of files you have. For example, it takes the program longer to index text files than to index spreadsheet or database files. However, when you update the index to include new files, *Magellan* works a great deal faster—5K to 10K per second. The program's index takes up

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about 5% of the disk space occupied by your files—much less space than that required by conventional full-text indexing programs.

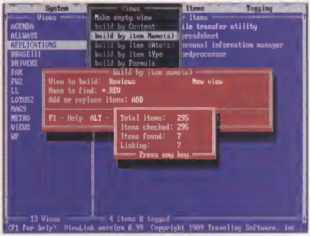
Magellan uses application-specific drivers, called viewers, to display the textual contents of files as that text would appear in its original program (*Magellan* cannot display graphics) and to launch a file and its program from your hard disk. *Magellan* will include viewers for most Lotus text-based programs and for other programs, including *dBase III, dBase III Plus,* and *dBase IV*; *WordPerfect* Version 5.0; *IBM DisplayWrite 3* and *DisplayWrite 4* Versions 1 and 1.2; *Microsoft Word* Versions 3.0 and 4.0; *WordStar* Versions 3.31 through 5.0 and *WordStar 2000*; *MultiMate* Version 3.3 and *MultiMate Advantage II*; and *XyWrite III Plus*. *Magellan* will also display any ASCII file.

—Bruce Brown

Lotus Magellan. Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 617-577-8500. Runs on the IBM PC, PC XT, PC AT, PS/2, and compatible computers. Requires 512K of RAM, DOS 2.1 or higher, and a hard disk. Introductory price of $139 through June 30, 1989; $195 thereafter.

CIRCLE 1 ON READER SERVICE CARD

ViewLink: An Alternative to DOS Subdirectories



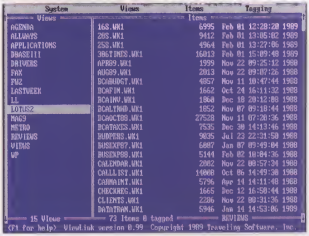
```
Views                         Items
AGENDA                        ile transfer utility
ALLWAYS                       preadsheet
APPLICATIONS                  ersonal information manager
DBASEIII                      ordprocessor
DRIVERS
FAX
FW2
LL
LOTUS2
MAG9
METRO
VIEWS
WP

Build by item name(s)
View to build:  Reviews              New view
Name to find: *.REV
Add or replace items: ADD
F1 - Help  ALT -

Total items:    295
Items checked: 295
Items found:    7
Linking:        7
Press any key

13 Views          4 Items 0 tagged
<F1 for help>  ViewLink version 0.99  Copyright 1989 Traveling Software, Inc.
```

Through *ViewLink*'s menu, you can quickly create Views that relate files by content, name, date of creation, or type. You can also create Views from a combination of these criteria.



```
Views           Items
AGENDA          16S.WK1          6995  Feb 01 12:28:20 1989
ALLWAYS         20S.WK1          9412  Feb 01 13:05:02 1989
APPLICATIONS    25S.WK1          4964  Feb 01 13:27:06 1989
DBASEIII        386TIMES.WK1    16013  Feb 01 15:09:48 1989
DRIVERS         APR89.WK1        1999  Nov 22 09:25:12 1988
FAX             AUG89.WK1        2013  Nov 22 09:07:26 1988
FW2             BCABUDGT.WK1     4857  Nov 11 10:47:44 1988
LASTWEEK        BCAFIN.WK1       1662  Oct 24 16:11:32 1988
LL              BCAINV.WK1       1860  Dec 18 20:12:08 1988
LOTUS2          BCALTRHD.WK1     1852  Nov 07 09:18:44 1988
MAG9            BCAOCT88.WK1    27528  Nov 11 07:20:36 1988
METRO           BCATAXES.WK1     7535  Dec 30 14:13:46 1988
REVIEWS         BUDPERS.WK1      9035  Jul 23 22:31:50 1988
VIEWS           BUSEXP87.WK1     6007  Jan 07 09:49:04 1988
WP              BUSEXP88.WK1     5144  Feb 02 10:04:36 1988
                CALENDAR.WK1     2002  Nov 22 08:57:34 1988
                CALLLIST.WK1    14008  Oct 06 14:49:30 1988
                CARMAINT.WK1     5796  Apr 14 14:11:48 1988
                CHECKREG.WK1     1665  Dec 12 16:50:44 1988
                CLIENTS.WK1      2286  Nov 22 08:31:36 1988
                DATATRAN.WK1     5946  Jan 14 14:53:06 1989
15 Views        73 Items 0 tagged        REVIEWS
<F1 for help>  ViewLink version 0.99  Copyright 1989 Traveling Software, Inc.
```

***ViewLink*'s display lists Views in the left window and the contents of the highlighted View in the right window. Views can also contain other Views and special *ViewLink* notes.**

If you have lots of files that contain information on the same topic but were created with different programs, *ViewLink* can help you organize those files in ways that DOS or conventional DOS shells cannot.

With *ViewLink* you can create relationships among files that contain related information or among files that you use for the same task. These relationships, called Views, can include files created with different programs. The benefit is that it's easier to let *ViewLink* keep track of your files than it is to do it yourself.

To create a View, you specify a criterion—a text string, file type, file name, file extension, or some combination thereof. If a file was created using any of the 55 programs *ViewLink* works with and if the file matches the criterion, it will be included in the view. You can also use this method to add new files to an existing view.

ViewLink's display is split into two windows. In the window on the left, the program lists your Views by name. As you move the cursor to highlight a View, you can see in the window on the right a list of files contained in that View. If you want to work with a file in the View, you can load both the program you used to create the file and the file itself with a single command.

How can *ViewLink* help you work faster? Suppose you create a monthly sales bulletin by first manipulating inventory data in a database program, then analyzing the data with a spreadsheet program, and finally incorporating the data into a word-processing program to produce the final report. If you want to organize these files with DOS, you might create a subdirectory of the same name in each program's directory. To create the report, you have to load each program from DOS and then scroll through your file names until you find the file with the current month's information.

ViewLink lets you create a View that contains only the files you need to produce the report. You can move from database file to spreadsheet file to word-processing file without loading programs from DOS and without scrolling through subdirectories and file names.

Unlike *Lotus Magellan* (see feature in this section), *ViewLink* doesn't let you view the contents of a file (unless, of course, the file is an ASCII file). It does, however, let you automatically load 55 software programs from its menu. If for some reason your program isn't among these, you can use *ViewLink*'s simple macro language to create a macro that loads your program.

ViewLink has been cast as a competitor to *Magellan*, but these programs are designed to do different things. *Magellan* is designed to help you find information in any file on your hard disk—whether or not you've ever asked for that information before. *ViewLink* is designed to give you quick access to a group of files you've used before for a predefined task.

You could use *ViewLink* to find infor-

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Excellent	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Good	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Fair	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Poor	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
N/A	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

TELL US HOW WE DID

The editors of *LOTUS* would appreciate your evaluation of the articles in this issue. This is easier than it may appear, and no postage is required.

1 Get the assigned number for each article from the Editorial Evaluation list on the facing page.

2 Find the article's number in the top row of the evaluation section of the card.

3 Circle the number that reflects your evaluation. If an article did not interest you at all, circle number 5.

We encourage you to *comment* on, as well as evaluate, the contents of this issue. Thanks in advance.

EDITORIAL EVALUATION

Your comments about *LOTUS* magazine help us bring you the best editorial product each month. To rate the articles in this issue, scan the list below and refer to the EDITORIAL EVALUATION card on the bottom of the insert to the left. Identify the number corresponding to each article, then circle the number on the card that reflects your rating.

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mation on your hard disk, but because it doesn't index all the data in your files and display files the way *Magellan* does, it would take you a lot longer to find the information you want. —*Bruce Brown*

ViewLink Version 1.0. Traveling Software, 18702 North Creek Pkwy., Bothell, WA 98011; 206-483-8088. Runs on the IBM PC, PC XT, PC AT, PS/2, and compatible computers. Requires 384K of RAM and DOS 2.0 or higher; hard disk recommended. Released 1/89. $149.95. Comes with both 3½- and 5¼-inch disks.

CIRCLE 2 ON READER SERVICE CARD

UTILITIES

Two Spreadsheet Compilers, One Provides Virtual Memory

Jaguar and *King Jaguar* let you compile worksheets and develop programs in *1-2-3*. A compiled worksheet is a copy of a *1-2-3* file that retains all the functionality of the original file and that you can use without loading *1-2-3*. Its formulas can't be altered and may even be hidden. This allows you to distribute worksheets to other people so that they can gather or process data without altering the original worksheet or seeing its underlying formulas, which you may choose to hide. Both programs compile formulas and macros from files in all releases of *1-2-3*, support all *1-2-3* functions, have multiple debugging features, provide minimum recalculation in compiled worksheets, and support expanded memory and math coprocessors.

King Jaguar lets developers use C language to add features that are not in *1-2-3*. The program lets you compile worksheets that will print sideways. If you have a hard disk with available memory, the software provides virtual memory—automatically moving part of your application to the hard disk when the size of the file exceeds the available RAM. This allows you to compile very large worksheets.

Runs with all releases of *1-2-3* on the IBM PC XT, PS/2, and compatible computers with a recommended 640K of RAM. Requires 384K of RAM to run a compiled worksheet and a hard disk to support virtual memory. *Jaguar* is $395, *King Jaguar* is $595, from Sheng Labs, 4470 Southwest Hall St., Suite 282, Beaverton, OR 97005; 800-548-1270.

CIRCLE 3 ON READER SERVICE CARD

Memory Manager Juggles as Many as 26 Pop-up Programs

HAL MAYFORTH

Extra solves the problem created when all the terminate-and-stay-resident (pop-up) utilities you load use too much memory. The program moves up to 26 pop-ups out of RAM and onto a hard disk or into extended or expanded memory until you need one or more of them. The program does not manipulate add-ins. *Extra* plus the pop-ups you run occupy as much RAM as the largest pop-up plus 35K for *Extra*. You can also remove the program and all pop-ups from memory.

A feature lets you build a menu from a list of 70 popular pop-ups, including *SideKick* and *Lotus Metro*, and you can add others manually. You can call up this menu to choose the pop-ups you want to run, and *Extra* invokes the hot keys to bring them into RAM.

Runs on the IBM PC, PS/2, and compatible computers with a hard disk, and uses 35K of RAM. Supports a mouse and extended and expanded memory. $99, from Delta Technology International, 1621 Westgate Rd., Eau Claire, WI 54703; 800-242-6368, in Wisc. 715-832-7575.

CIRCLE 4 ON READER SERVICE CARD

Transfer Unfriendly Files

DBMS/Copy lets you transfer files among a variety of spreadsheet, database, data-entry, and statistics packages, as well as among fixed-format, free-format, and mail-merge ASCII files. The program is useful to someone who uses multiple applications or who has many clients, each of whom uses different database applications. It writes and reads data to and from all versions of *1-2-3, Symphony, Quattro, dBase, Paradox, R:Base, Reflex, Oracle, SPSS*, and other programs. *DBMS/Copy* copies the file from one program's proprietary format into another's, retaining original formats, such as date, currency, and fixed formats. You can transfer network-compatible files on a LAN. Except for *Oracle*, you don't have to run an application to retrieve the file.

Runs on the IBM PC, PS/2, and compatible computers with DOS 2.1 or higher. Uses 256K of RAM. Manufacturer recommends a hard disk. $195 for a single user, $795 for an unlimited number of users, from Conceptual Software, P.O. Box 56627, Houston, TX 77256-6627; 800-782-8969.

CIRCLE 5 ON READER SERVICE CARD

Decision Pad/1-2-3 Connection

Smart Import lets you import into the decision-analysis software *Decision Pad* selected data from any program that writes WKS and WK1 files. You can import selected rows and columns from the worksheet or let *Smart Import* transfer row and column headings from *1-2-3* to set up a similar worksheet format in *Decision Pad.*

Requires *Decision Pad* Version 1.1 or 1.2; runs on the IBM PC, PS/2, and compatible computers; and uses 256K of RAM. Manufacturer recommends a hard disk. $45, from Apian Software, P.O. Box 1224, Menlo Park, CA; 800-237-4565, in Calif. 415-851-8496.

CIRCLE 6 ON READER SERVICE CARD

Speed up Some dBase Processes

dBoost's manufacturer claims its program accelerates by 30% to 50% certain routines in *dBase* and *dBase* compilers. The terminate-and-stay-resident program speeds up *dBase*'s ability to write and read data to and from files, search, create index files, and produce reports. Calculations are not affected. You can remove the program from memory. It supports expanded memory.

Runs with *dBase III, dBase III Plus, dBase IV*, and the *dBase* compilers *Clipper, FoxBase*, and *QuickSilver* on the IBM PC, PS/2, and compatible computers. Uses from 8K to 20K of RAM, depending on the procedure, and manufacturer recommends a hard disk. $69.95, from Isogon Corp., 330 Seventh Ave., New York, NY; 800-662-6036.

CIRCLE 7 ON READER SERVICE CARD

MARKET SOFTWARE

Program Analyzes Markets Using 1-2-3/Symphony Data

Momentum allows you to perform market-timing analysis that helps you decide what and when to buy or sell for all stocks, mutual funds, and commodities with at least a one-year trading history. The program lets you produce a unique set of short- and long-term moving averages for each security or fund. It also produces a stochastic indicator, which analyzes an item's closing prices over a period of time. The program uses data from a PRN file.

Runs on the IBM PC, PS/2, and compatible computers. Uses 256K of RAM. Manufacturer recommends a hard disk. Includes at least three-year's worth of data on any 10 stocks, commodities, mutual funds, market indexes, or any combination thereof. Additional securities are available for $2 apiece for weekly data, $3.50 apiece for daily data. $89.95, from Momentum, Inc., P.O. Box 470146, Charlotte, NC 28226; 704-542-3641.

HAL MAYFORTH

CIRCLE 8 ON READER SERVICE CARD

Options-Trading 1-2-3 Add-in

@Option, a library of 36 @functions, helps you make trading decisions on U.S. stock options and index options. It also lets you perform sensitivity analysis. Sets of functions cover price, delta, beta, gamma, theta, vega, and implied volatility fluctuations, among others. The program is compatible with *Lotus Signal*, which means you can use real-time data.

Requires *1-2-3* Release 2/2.01. Uses 13K of RAM. Demo version that runs for three months is $25. $315, from Financial Functions, 400 South LaSalle St., Box 777, Chicago, IL 60605; 800-622-4070, in Ill. 800-942-7317.

CIRCLE 9 ON READER SERVICE CARD

1-2-3/Symphony Add-in for U.S. and Foreign Options

Options 1~2~3: The Pro Series is a set of @functions that allows you to price options for stocks, futures, foreign exchanges, bonds, indexes, commodities, and metals. You can also perform sensitivity analyses. Special functions let you allow for dividend yields, enter zero holding costs on futures, compare international interest rates, and find treasury bond–yield adjustments. The package includes templates that show you basic options @functions, how to select @functions, and how to graph sensitivity analyses. The program is compatible with *Lotus Signal*, Knight-Ridder's Data Feed service, and Wang Financial Information Services Corp.'s Shark service.

Requires *1-2-3* Release 2/2.01 or *Symphony* 1.2 or 2.0. Uses 25K of RAM. Manufacturer recommends a hard disk. *1-2-3* version is $695, *Symphony* version is $795, from Montgomery Investment Group, 332 Pine St., Suite 504, San Francisco, CA 94104; 415-986-6991.

CIRCLE 10 ON READER SERVICE CARD

OTHER SOFTWARE

Attitude-Survey Design, Tabulation, and Reports

PC/Stargraph lets you conduct a company's entire attitude-survey process on your PC. You can create a database that tracks the position of each survey question on both the original and follow-up surveys. The program lets you tabulate survey results and produce reports and graphs. With it you can automatically generate tables by key items, such as department, division, men, or women. Reports may be from eight statistical groupings, such as the percentage of employees responding to all questions or the average number of responses. The program lets you prepare graphs relating to a survey topic, such as job satisfaction, for the whole company or by each division. The program reads from and writes to any standard ASCII file and writes to PRN files.

Runs on the IBM PC AT, PS/2, and compatible computers with 640K of RAM. Manufacturer suggests 1 megabyte of RAM and a 20-megabyte hard disk. $3,500, from Questar Data Systems, 2905 West Service Rd., Eagan, MN 55121-2199; 612-688-0089.

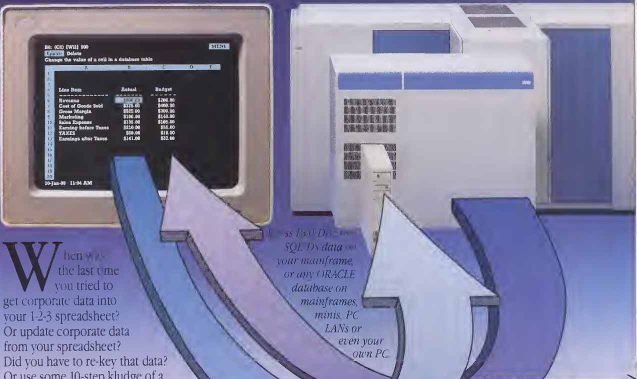
CIRCLE 11 ON READER SERVICE CARD

Employee-Scheduling Software

Working Hours lets managers schedule any number of employees for all shifts on a weekly basis. The program tracks when employees are not available and alerts you to schedule conflicts. You can print a master calendar as well as schedules for individuals.

Runs on the IBM PC and compatible computers with 256K of RAM. Supports most dot-matrix and laser printers. $99.95, from Power Up Software Corp.,

ORACLE® joins 1-2-3 and your corporate database



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B6: (C2) [W11] 900                                        MENU
Update Delete
Change the value of a cell in a database table
      A                    B            C        D      E
 1
 2
 3
 4   Line Item             Actual       Budget
 5   --------------        -------      ------
 6   Revenue               $900.00      $700.00
 7   Cost of Goods Sold    $375.00      $400.00
 8   Gross Margin          $525.00      $300.00
 9   Marketing             $180.00      $140.00
10   Sales Expense         $135.00      $108.00
11   Earning before Taxes  $210.00       $55.00
12   TAXES                  $69.00       $18.00
13   Earnings after Taxes  $141.00       $37.00
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Access IBM DB2 or SQL/DS data on your mainframe, or any ORACLE database on mainframes, minis, PC LANs or even your own PC.

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$______ Please add appropriate sales tax
$______ **Total** *(Oracle pays shipping)*

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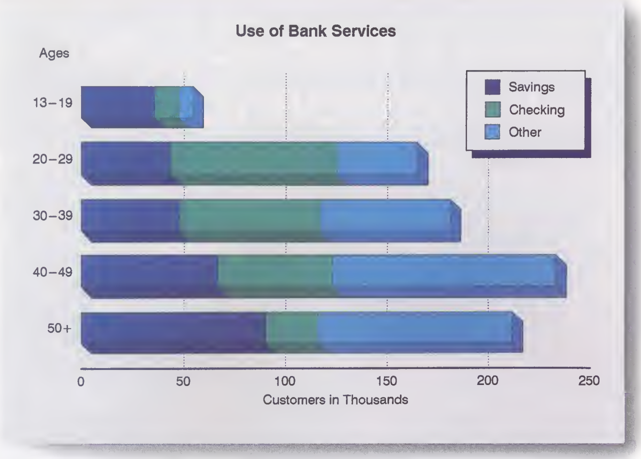

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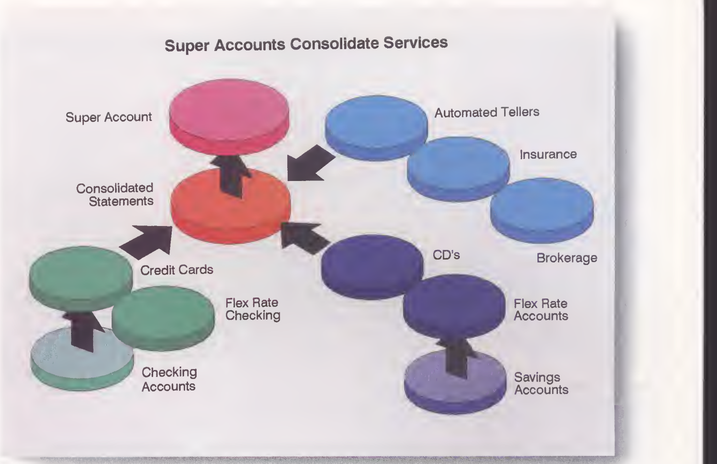

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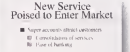

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CIRCLE 12 ON READER SERVICE CARD

Driver Links WordPerfect 5.0 and Quadram's JT Fax Board

Quadram Corp. and Wordperfect Corp. have developed a driver that lets you select any of the four JT Fax boards as an output device in *WordPerfect* 5.0. This lets you send computer-generated copy via the fax board to a fax machine, which prints the copy. Such copy is clearer than copy that is both scanned and sent by a fax machine. At this time the driver supports only two fonts: normal (Courier 10) and compressed, which allows 132 characters per line. It does not support graphics.

For *WordPerfect* 5.0 and the JT Fax series of boards. Free, from Quadram Corp., One Quad Way, Norcross, GA 30093-2919; 404-923-6666 or Quadram's bulletin board, 404-564-5705.

CIRCLE 13 ON READER SERVICE CARD

Statistics Templates for MathCAD Program

Statistics I: Tests and Estimation and *Statistics II: Modeling and Simulation* allow scientists and engineers to solve equations on the PC instead of on paper. *Stat I* has a set of standard routines using parametric and nonparametric techniques. *Stat II* offers techniques for creating models to perform multiple regression analysis and simple Monte Carlo simulations. Both programs execute 16 standard statistical procedures, such as finding frequency, cumulative, and probability distributions and generating random deviations. The programs read from and write to PRN files.

Requires *MathCAD* Version 2.0 ($349) and runs on the IBM PC, PS/2, and compatible computers with 512K of RAM. Manufacturer recommends a hard disk and 640K of RAM. $59 for *Stat I*, $69 for *Stat II*, $99 for both, from MathSoft, One Kendall Sq., Cambridge, MA 02139; 800-628-4223, in Mass. 617-577-1017.

CIRCLE 14 ON READER SERVICE CARD

Calendar and Scheduler Are Free (for the Time Being)

CC7 Computer Calendar is a free program that lets you schedule daily activities. The hitch is that it stops January 31, 1990, and an update will cost $39.95. The calendar shows four weeks at once, and you can scroll forward and backward or zoom in on the activities of any day. You can create a database of names and addresses and search on any string of characters. You can also print letters and envelopes from the database. The program does not have an automatic phone-dialing feature. It includes a pop-up text editor, calculator, and other utilities.

Runs on the IBM PC XT, PS/2, and compatible computers with 512K of RAM and a hard disk. $3 for shipping and handling, $39.95 next year for an update, from EPI Computer,· Dept. NLOT9DC, 688 Asbury Ave., Farmingdale, NJ 07727; 800-631-2295, in N.J. 201-938-6025.

CIRCLE 15 ON READER SERVICE CARD

HARDWARE

19-Inch Monochrome Monitor for Two-Page Display

The Xerox Panorama 19-inch monitor and XGA (Xerox Graphics Adapter) card were designed to be used with desktop-publishing and spreadsheet programs. The monitor lets you see 144 columns by 53 lines of text, as well as two full pages of graphics at a resolution of 1,216-by-925 pixels. It is compatible with all releases of *1-2-3*, *Symphony* Release 1.1 or higher, and all software that is compatible with the IBM MDA, CGA, and Hercules graphics cards. The monitor works in conjunction with any graphics card, and it automatically adjusts to European 220 voltage without modification.

Runs on the IBM PC, PS/2 Model 30, Compaq 386, and compatible computers, and uses one full-size slot. $1,995 for the monitor and card, from Xerox Corp., 475 Oakmead Pkwy., Sunnyvale, CA 94086; 800-222-9827, in Calif. 408-737-4100.

CIRCLE 16 ON READER SERVICE CARD

TRAINING

Basic and Advanced dBase IV on Tapes, Disks, and Books

Using dBase IV and *Advanced dBase IV Learning System* teach the fundamentals and advanced concepts of the popular database program. Each is a self-paced program that includes videotapes, software, and workbooks. The advanced unit teaches programming, macros, and IBM's Structured Query Language protocol.

Runs on the IBM PC, PS/2, and compatible computers with 512K of RAM. $495 for one, $895 for both, in VHS or Beta format. $595 for one, $995 for both, in ¾-inch format. From MicroVideo Learning Systems, 119 West 22nd St., New York, NY 10011; 800-231-4021, in N.Y. 212-255-3108.

CIRCLE 17 ON READER SERVICE CARD

WordPerfect 5.0 with 4.2

Individual Training for WordPerfect 5.0 is a software-based, interactive tutorial. It shows you how to create, edit, lay out, and print documents. The program emphasizes how to use graphics with *WordPerfect*. The differences between Version 5.0 and Version 4.2 are covered.

Requires *WordPerfect* Version 5.0. Runs on the IBM PC, PS/2, and compatible computers with 640K of RAM. $69.95, from Individual Software, 125 Shoreway Rd., Suite 3000, San Carlos, CA 94070-2704; 800-331-3313, in Calif. 415-595-8855.

CIRCLE 18 ON READER SERVICE CARD

UPGRADES

Perspective Junior is a redesigned and friendlier version of the discontinued program *BoeingGraph*. It has drivers for the desktop-publishing programs *PageMaker* and *Ventura Publisher*, improved page-layout capabilities, and preset print

HAL MAYFORTH

routines. You can save graph-configuration data in files, which you can use as templates that can import spreadsheet data. The program processes contiguous data in a spreadsheet as a range and can graph it for you automatically, using column headings as graph titles. The program reads WKS, WK1, DIF, SYLK, and ASCII file formats. From a menu, you can choose among thirteen 3-D or eight 2-D graph types. You can create presentations that resemble slide shows and run automatically or manually on your PC screen. The Option Pak ($69) supports more than 40 plotters, as well as the Polaroid PalettePlus Computer Image Recorder.

Runs on the IBM PC, PS/2, and compatible computers with 512K of RAM and a hard disk. Requires an EGA or VGA graphics card to support full-color graphics, but runs with any major graphics card. $149, from Three D Graphics, 860 Via de la Paz, Pacific Palisades, CA 90272; 213-459-7949.

CIRCLE 19 ON READER SERVICE CARD

Tim Berry's Business Plan Toolkit workbook and software has new pro forma statements and a revised manual covering the basics of how to use the software, how to prepare a business plan, and more information. Both the software and book have sample business plans for small-size to medium-size businesses. All statements are interactive so that cells that are linked but on different statements get updated automatically.

Requires any release of *1-2-3* and 384K of RAM, which includes *1-2-3*'s memory requirement. $99.95, from Palo Alto Software, 260 Sheridan Ave., Suite 219, Palo Alto, CA 94306; 800-336-5544, in Calif. 415-325-3190.

CIRCLE 20 ON READER SERVICE CARD

Beyond Word Writer (*BWW*) features screens and menus that resemble those in products such as *1-2-3, WordStar* Version 4.0, *WordPerfect* Version 5.0, *Microsoft Word*, and *Professional Write* Version 2.0. This means you can use familiar keystrokes to select commands such as Retrieve, Save, Copy, Print, and others. You can exchange files between *BWW* and the programs above plus *MultiMate, IBM DisplayWrite, OfficeWriter,* and *IBM Writing Assistant.*

The program lets you create and display as many as 10 newspaper-style columns with a maximum combined width of 250 characters. *BWW* provides automatic word wrap, and automatically numbered footnotes appear on the same page as the text to which they refer or at the end of a document. The program can automatically generate an index or table of contents. A 100,000-word spelling checker includes some computer terms, such as *byte* and *hard drive*, and a readability index reports the educational level necessary to read your document.

Runs on the IBM PC, PS/2, and compatible computers with 512K of RAM. $199.95, from Timeworks, 444 Lake Cook Rd., Deerfield, IL 60015; 312-948-9200.

CIRCLE 21 ON READER SERVICE CARD

HAL MAYFORTH

dQuery Version 2.1 lets you query all *1-2-3, Symphony*, and *dBase* files and generate reports. You can combine the query results and save them formatted as worksheet, *dBase*, or ASCII files. *dQuery/Net* Version 2.1 is a multiuser version that runs on a local area network.

Both programs run on the IBM PC and compatible computers with 450K of available RAM and a hard disk. *Query/Net* Version 2.1 requires DOS 3.1 or higher and runs on a NetBIOS-compatible LAN. $150 for a single-user version and $495 for a five-user version. From Quadbase Systems, 790 Lucerne Dr., Suite 51, Sunnyvale, CA 94086; 408-738-6989.

CIRCLE 22 ON READER SERVICE CARD

Org Plus Advanced draws organizational charts automatically after you've entered names, titles, and comments. You can include as many as 600 positions. The program lets you customize the chart by adding vertical and horizontal lines, boxes, and special print attributes for creating boldface and italic type and underlines.

Runs on the IBM PC and compatible computers with 384K of RAM. Supports most printers and plotters. $129.95, from Banner Blue, P.O. Box 7865, Fremont, CA 94537; 415-794-6850.

CIRCLE 23 ON READER SERVICE CARD

InstaPlan Version 2.0 lets you create an outline that includes multiple projects and lets you maintain a project-history database. The program can import files from any release of *1-2-3*. You can use it to plan, track, and document as many projects as your computer memory allows, using either the critical path method or a time-based planning method. The project-history database provides details of work in progress, labor, and expenses by the day, week, or any other time increment. Using the database, you can compare a project's original plan and schedule to the project's current status, as well as to proposed changes to the plan and schedule.

Runs on the IBM PC, PS/2, and compatible computers with 640K of RAM. $99 to $239, depending on feature options, from InstaPlan Corp., 655 Redwood Hwy., Suite 311, Mill Valley, CA 94941; 800-852-7526, in Calif. 415-389-1414.

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BOOKS

The Good Ideas Book, by *LOTUS* magazine staff. Published July 1988, 316 pages, $19.95, from Addison-Wesley Publishing Co., Reading, MA 01867; 617-944-3700.

CIRCLE 25 ON READER SERVICE CARD

The Computer Industry Almanac 1989, by Egil Juliussen and Karen Juliussen. Published December 1988, 800 pages, $29.95, from Brady Books, Simon & Schuster Reference Div., One Gulf+Western Plaza, New York, NY 10023; 212-373-8142.

CIRCLE 26 ON READER SERVICE CARD

Groupware: Computer Support for Business Teams, by Robert Johansen. Published October 1988, 205 pages, $27.95, from The Free Press, 866 Third Ave., New York, NY 10022; 212-702-2000.

CIRCLE 27 ON READER SERVICE CARD

Webster's New World Dictionary of Computer Terms. Published November 1988, 412 pages, $6.95, from Simon & Schuster General Reference Div., One Gulf+Western Plaza, New York, NY 10023; 212-373-8234.

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Information for New Products is supplied by the vendors and was up-to-date as of 2/21/89. Since production specifications change frequently, we recommend that you verify this information with a dealer before making a purchase.

ESSAY

APPLE FOCUSES ON THE DULL BUT IMPORTANT

BY FRANK ROSE

Not too many years ago, when Steve Jobs was riding high at Apple Computer, he and his followers had a pet name for the folks who produced the Apple II, the company's cash cow. They called them "the dull and boring division." The Apple II lacked the whizbang features of the machine that Jobs and his team were developing, the machine that was going to change the world. Jobs's Macintosh was the "hot box"; the Apple II was yesterday's technology. Now, however, the Macintosh is turning into yesterday's technology, and the whole company is beginning to look a little dull and boring. In fact, the hottest box in Apple's product line isn't a box at all. It's a videotape.

Apple's "Knowledge Navigator" videos, currently six in all, illuminate different aspects of the computer of the future. Intended to provide an inspirational view of distant horizons, the videos dramatize technologies that are 5 to 20 years away. Most of the ideas behind these technologies draw heavily on the Dynabook, the name Alan Kay has given to his 20-year-old vision of an infinitely useful, infinitely portable, infinitely *personal* personal computer.

The first of the videos was greeted with whoops of excitement, when it was originally screened in what Apple called a "vision rollout" at a Los Angeles educators' conference and later when it was shown to groups of Apple employees at Cupertino's Flint Center. Now officials at the Kenwood Group, the San Francisco studio that produced the video series for Apple's creative services department, cite reports of bootleg copies being passed around, an honor once reserved for unreleased Bob Dylan tapes and novels by Soviet dissidents.

Unfortunately, the "Knowledge Navigator" series also serves as a measure of the discrepancy between vision and reality. A reminder of just how far Apple is from its own vision came recently from analyst Richard Shaffer, who remarked in his *Technologic Computer Letter* that the tasks Apple faces in 1989 are "dull but important." When *Business Week* retorted, "Can the company that once defined itself in terms of revolution get by on dull but important?" Shaffer's words turned into a taunt.

So what has happened at John Sculley's Apple? Has the baton been passed from engineering to creative services? Actually, no, but it has been passed from engineering to research and development. One of the chief differences between Apple in 1984 and Apple today is that Sculley's technology guru then was Steve Jobs; now it's Alan Kay, the visionary computer scientist whose research team at Xerox's Palo Alto Research Center (PARC) pioneered most of the concepts that were realized years later in the Macintosh.

It was Jobs who lured Kay to Apple Computer from Atari Corp., where he'd gone after the PARC team split up at the end of the 1970s. But Jobs and Kay didn't get along very well, and it wasn't hard to figure out why. Jobs thinks like an engineer, someone for whom the task is to get things built. Kay thinks like a scientist, someone for whom the goal is to find out what *can* be built. Kay likes to operate on the outer fringes of the possible, while Jobs prefers to operate on the outer fringes of the deliverable.

Kay played no role in the 1985 showdown between Jobs and Sculley, but once it was over, Kay and Sculley formed a mutual-admiration society. Sculley thought of Kay as a Renaissance man; after he agreed to bankroll Kay's research project, Kay started comparing Sculley with Lorenzo de'Medici. Sculley reasoned that Apple was sure to end up with some exciting, new ideas.

On a more realistic plane, Sculley had to deal with corporate sales and the emergence of a "multivendor environment"—that is, a marketplace dominated not by any one supplier but by the customer's need to link different types of computers in a smoothly functioning system. This is the evolutionary approach that has recently characterized Apple's product announcements.

Apple's new watchwords are *compatibility* and *connectivity*. The company can no longer afford to take Jobs's old view, that compatibility is the noose around creativity. For Macintosh to succeed in the business world, Apple must deliver machines that talk with each other and with the rest of the world.

So for the short term, you have dull but important, and for the long term, you have the benefits of Kay's art-of-the-possible R&D. And in the meantime, the great thing about the "Knowledge Navigator" is that the only industry standard it has to meet is VHS. ■

Frank Rose is the author of West of Eden *(New York: Viking Press, 1989), a history of Apple Computer from 1983 to 1986.*

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